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- Scientific and technical reports of government agencies, universities, and research organizations throughout the world.

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Table of Contents

Volume 4 Number 24 / December 23, 1966

Abstracts in the journal are grouped under the following categories: PAGE

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion. 4641

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics. 4645

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems. 4646

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology. 4649

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences. 4656

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants. 4661

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation. 4665

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics. 4675

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation. 4681

10 ELECTRONICS
Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories. **4690**

11 FACILITIES, RESEARCH AND SUPPORT
Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations. . . . **4697**

12 FLUID MECHANICS
Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion. **4698**

13 GEOPHYSICS
Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences. **4705**

14 INSTRUMENTATION AND PHOTOGRAPHY
Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras. **4714**

15 MACHINE ELEMENTS AND PROCESSES
Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, reliability; drafting; and materials fabrication, handling, and inspection. **4725**

16 MASERS
Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State. **4729**

17 MATERIALS, METALLIC
Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics. **4731**

18 MATERIALS, NONMETALLIC
Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics. **4742**

19 MATHEMATICS
Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers. **4744**

20 METEOROLOGY
Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences. **4748**

21 NAVIGATION
Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications. **4751**

22 NUCLEAR ENGINEERING
Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems. **4753**

23 PHYSICS, GENERAL
Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology, and 29 Space Radiation. 4763

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR
Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation. 4769

25 PHYSICS, PLASMA
Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems. 4776

26 PHYSICS, SOLID-STATE
Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics. 4781

27 PROPELLANTS
Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems. 4783

28 PROPULSION SYSTEMS
Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants. 4784

29 SPACE RADIATION
Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear. 4787

30 SPACE SCIENCES
Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles. 4792

31 SPACE VEHICLES
Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics. 4797

32 STRUCTURAL MECHANICS
Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic. 4799

33 THERMODYNAMICS AND COMBUSTION
Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants. 4808

34 GENERAL
Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents. 4814

SUBJECT INDEX I–1

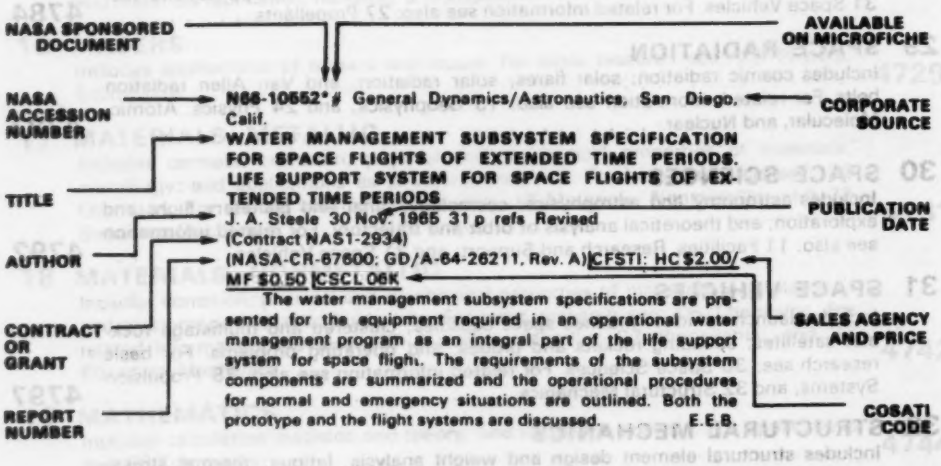
CORPORATE SOURCE INDEX I–55

PERSONAL AUTHOR INDEX I–71

REPORT/ACCESSION NUMBER INDEX I-99

ACCESSION/REPORT NUMBER INDEX I-109

TYPICAL CITATION AND ABSTRACT FROM *STAR*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N66-10552* # General Dynamics/Astronautics, San Diego, Calif.
CORPORATE SOURCE
TITLE
WATER MANAGEMENT SUBSYSTEM SPECIFICATION FOR SPACE FLIGHTS OF EXTENDED TIME PERIODS. LIFE SUPPORT SYSTEM FOR SPACE FLIGHTS OF EXTENDED TIME PERIODS
PUBLICATION DATE
AUTHOR
J. A. Steele 30 Nov. 1965 31 p refs Revised
(Contract NAS1-2934)
CONTRACT OR GRANT
REPORT NUMBER
(NASA-CR-67600; GD/A-64-26211, Rev. A) CFSTI: HC $2.00/MF $0.50 CSCL 06K
SALES AGENCY AND PRICE
The water management subsystem specifications are presented for the equipment required in an operational water management program as an integral part of the life support system for space flight. The requirements of the subsystem components are summarized and the operational procedures for normal and emergency situations are outlined. Both the prototype and the flight systems are discussed. E.E.B.
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VOLUME 4 NUMBER 24

Scientific and Technical Aerospace Reports

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December 23, 1966

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N66-39067# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.

APPROXIMATE SOLUTIONS FOR COMPUTING HELICOPTER HARMONIC AIRLOADS

Michael P. Scully Dec. 1965 38 p refs

(Contract NOW-64-0188-d)

(TR-123-2; AD-636928) CFSTI: HC $3.00/MF $0.50

Assuming a constant circulation, rigid, trailing wake and using a lift deficiency function to represent the unsteady aerodynamic effects, various methods of calculating the airloads on a helicopter rotor in steady, forward flight were developed for the purpose of achieving: (a) faster solution times for a given level of accuracy and (b) a more accurate representation of the lifting surface/vortex interaction for the case where the blade passes close to the vortex line generated by a previous blade. Since most of the solution time is required to calculate the induced velocities due to the trailing wake, various approximate methods of calculating the induced velocities due to a rigid, skewed helix were developed.

Author (TAB)

N66-39396*# Rice Univ., Houston, Tex.

TWO-DIMENSIONAL, POWER-LAW WINGS OF MAXIMUM LIFT-TO-DRAG RATIO IN HYPERSONIC FLOW

Angelo Miele and William L. Wilson 1966 35 p refs

(NASA Grant NGR-44-006-045)

(NASA-CR-78760; AAR-23) CFSTI: HC $2.00/MF $0.50 CSCL 01A

The problem of maximizing the lift-to-drag ratio of a slender, flat-top, hypersonic wing is investigated under the assumptions that the pressure distribution is Newtonian and the skin-friction coefficient is constant. Direct methods are employed, and the analysis is confined to the class of two-dimensional wings whose chordwise contour is a power law. First, unconstrained configurations are considered, and the combination of power law exponent and thickness ratio maximizing the lift-to-drag ratio is determined. For a friction coefficient $C_f = 10^{-3}$, the maximum lift-to-drag ratio is $E = 5.29$ and corresponds to a wedge of thickness ratio $\tau = 0.126$. Next, constrained configurations are considered, that is, conditions are imposed on the length, the thickness, the enclosed area, and the position of the center of pressure. For each combination of constraints, an appropriate similarity parameter is introduced, and the optimum power lay exponent, thickness ratio, and lift-to-drag ratio are determined as functions of the similarity parameter.

Author

N66-39417# Weapons Research Establishment, Salisbury (Australia).

THE FEASIBILITY OF CONVENTIONAL PARACHUTE OPERATION AT SUPERSONIC SPEEDS

M. L. Robinson and S. Gower (Adelaide Univ.) Mar. 1966 45 p refs

(WRE-TN-HSA-114) CFSTI: HC $2.00/MF $0.50

The drag performance and flow characteristics of rigid models representing Taylor and guide surface parachute canopies have been investigated at Mach numbers 1.6, 2.2 and 2.8. It has been observed that a short-rigged flexible Taylor canopy attached to the payload by a strop can operate successfully as a decelerator at supersonic speeds provided that the distance between payload and canopy exceeds approximately 2.5 canopy diameters. In addition, the results have indicated that a flexible guide surface canopy is not capable of successful operation at supersonic speeds because of its inflation characteristics. However, the drag performance of a short-rigged rigid guide surface canopy attached to the payload by a strop is good when the distance between payload and canopy exceeds approximately 2.5 canopy diameters, and hence this canopy shape deserves consideration as a rigid decelerator. Periodic flow instability similar to that observed in previous spiked bluff body investigations was experienced by the present parachute configurations when the payload was located close to the canopy.

Author

N66-39486# Lockheed-Georgia Co., Marietta.

METHODS FOR ANALYSIS OF TWO-DIMENSIONAL AIRFOILS WITH SUBSONIC AND TRANSONIC APPLICATIONS Final Report, 1 Jul. 1965-30 Jun. 1966

J. A. Bennett and S. H. Goradia 21 Jul. 1966 376 p refs

(Contract DA-31-124-ARO(D)-398)

(ER-8591; AROD-6074-1; AD-637603) CFSTI: HC $7.00/MF $1.75

The report presents a method for describing the subsonic, viscid, attached flow about two-dimensional airfoils with applications to transonic flow. The method utilizes state-of-the-art technology to analyze all aspects of the flow and combines boundary layer solutions with inviscid pressure distribution prediction methods to obtain a complete solution. This complete solution is represented by a pressure distribution at any point on the airfoil which reflects the viscid, inviscid, and compressible effects in proper combination. The solution is programmed for an IBM 7094 computer in which the required inputs are freestream flow conditions and airfoil geometry only. The program computes the pressure and boundary layer distribution using an iterative procedure to attain equilibrium conditions. These data, as well as the lift, drag and pitching moment of the viscid solution and the inviscid pressure distribution are provided as output. Methods for applying the results to analyze practical subsonic and transonic design problems are discussed.

Author (TAB)

N66-39517# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.

AN ACTUATOR DISC THEORY FOR THE SHED WAKE AT LOW TIP SPEED RATIOS

J. P. Jones [1965] 55 p refs

(Contract NOw-65-139-d)

(TR-133-1, AD-637744) CFSTI: HC $3.00/MF $0.50

A model of the flow through a helicopter rotor, suitable for estimating shed wake effects in hovering and at low tip speed rations, is described. The method leads to the same result for the aerodynamic damping of blade bending oscillations as more complex theories. It is shown that the damping of small natural oscillations is to a first order unaffected by tip speed ratio. Interharmonic couplings, arising out of the convection of the shed vorticity parallel to the rotor disc, prove to be quite important, especially if resonance occurs. Also, in the presence of strong interharmonic coupling, the effective lift curve slope cannot be considered as a universal parameter, independent of the harmonic content of the blade motion Author (TAB)

N66-39533*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

AERODYNAMIC DATA ON A LARGE SEMISPAN TILTING WING WITH A 0.8-DIAMETER CHORD, A DOUBLE-SLOTTED FLAP, AND LEFT-HAND AND RIGHT-HAND ROTATION OF A SINGLE PROPELLER, IN PRESENCE OF FUSELAGE

Marvin P. Fink Washington, NASA, Nov. 1966 121 p refs

(NASA-TN-D-3674) CFSTI: HC $3.00/MF $1.00 CSCL 01C

An investigation has been made in the Langley full-scale tunnel to determine the longitudinal aerodynamic characteristics of a large-scale semispan V/STOL tilt-wing configuration having a single propeller rotating in both left- and right-hand directions. The model was tested in the presence of a fuselage and the loads on the fuselage were measured separately. The wing had a chord-to-propeller-diameter ratio of 0.5, a double-slotted flap, an aspect ratio of 4.88 (2.44 for the semispan), a taper ratio of 1.0, and a NACA 4415 airfoil section. Tests were made of the configuration with and without leading-edge slat and fences. It was found that when leading-edge flow-control devices were not used, the direction of propeller rotation had a significant effect on the lift and descent capability attainable. The use of flap deflection was very effective in increasing the descent capability for either mode of rotation. For example, with the most favorable combination of flow-control devices investigated, virtually no descent capability prior to wing stalling was achieved with 0° flap deflection; whereas, with 20°, 40°, or 60° flap deflection, a descent capability of about 20° was achieved. Author

N66-39534*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

AERODYNAMIC CHARACTERISTICS OF A SERIES OF SPHERICALLY BLUNTED 10° CONES WITH 30° AND 60° BASE FLARES

Julius E. Harris Washington, NASA, Oct. 1966 50 p refs

(NASA-TN-D-3675) CFSTI: HC $2.00/MF $0.50 CSCL 01A

Force and moment tests have been conducted on a series of 10° semiapex-angle spherically blunted cones with 30° and 60° semiapex-angle base flares in the Langley 11-inch hypersonic tunnel at a Mach number of 9.75 and a Reynolds number based on cone base diameter of 1.56×10^5 for angles of attack from 0° to 45°. Analysis of the experimental force and moment data from the present investigation indicated that all the configurations were statically stable about a point located on the axis of symmetry one-tenth of a cone base diameter ahead of the centroid of the cone planform area. From schlieren and oil flow studies, the separation induced by the base flares was found to decrease with increasing bluntness ratio for a constant flare angle and to increase with increasing flare angle for a constant bluntness ratio. Agreement between the experimental force and moment coefficients and Newtonian approximations was poor. Author

N66-39541*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

HYPERSONIC AERODYNAMIC PERFORMANCE OF MINIMUM-WAVE-DRAG BODIES

Bernard Spencer, Jr. and Charles H. Fox, Jr. Washington, NASA, Nov 1966 52 p refs

(NASA-TR-R-250) CFSTI: HC $2.00/MF $0.50 CSCL 01A

An experimental investigation has been made at a Mach number of 10.03 to determine the longitudinal aerodynamic characteristics of a series of power-law bodies having values of the exponent of 0.25, 0.50, 0.66, 0.75, and 1.00, and a theoretical hypersonic minimum-wave-drag body. For each body, cross-sectional shape was altered from circular to elliptic, while maintaining a constant longitudinal distribution of cross-sectional area. For the series of power-law bodies tested, a minimum in the variation of zero-lift drag with body exponent occurs for an exponent of 0.66 for ellipse ratios of 1.0 or 2.0; a resultant maximum in the variation of maximum lift-drag ratio with body exponent was also found for an exponent of 0.66 for ellipse ratios of either 1.0 or 2.0. The zero-lift drag characteristics of the theoretical minimum-wave-drag body are slightly lower than those noted for the 0.66-power body, and the resultant maximum lift-drag-ratio characteristics are somewhat higher for ellipse ratios of either 1.0 or 2.0. The effects of increasing ellipticity, for a given power body or the theoretical body, resulted in an almost constant incremental increase in maximum lift-drag ratio, independent of body longitudinal contour. Author

N66-39561# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.

A ROUTINE METHOD FOR THE CALCULATION OF AERODYNAMIC LOADS ON A WING IN THE VICINITY OF INFINITE VORTICES

Denis J. Kfoury Washington, Bur. of Naval Weapons, May 1966 45 p refs

(Contract NOw-65-0139-d)

(ASRL-TR-133-2; AD-637745) CFSTI: HC $2.00/MF $0.50

The vortex lattice method for the calculation of loads on a wing advancing in a uniform stream was extended to the case of a wing in the vicinity of infinite vortices. No experimental data or different treatments of the same problem being available in the literature in order to verify the accuracy of the present method, the results in the report had to be limited to checking their convergence with respect to the three parameters involved and investigating what conditions them. The problem being treated linearly, only the simple case of one infinite vortex at the midspan of a wing at zero angle of attack was tested, with the understanding that the method can be applied to more complicated cases once its convergence and its validity have been shown Author (TAB)

N66-39607*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

LONGITUDINAL AERODYNAMIC CHARACTERISTICS AT A MACH NUMBER OF 3.0 OF AN ARROW WING WITH BODIES OF CIRCULAR AND SEMICIRCULAR SECTIONS

Walter A. Vahl and Waldo I. Oehman Washington, NASA, Jun. 1963 21 p refs

(NASA-TM-X-825) CFSTI: HC $1.00/MF $0.50 CSCL 01A

An experimental investigation was conducted in the Langley Unitary Plan wind tunnel to determine the longitudinal aerodynamic characteristics of an arrow wing with three body shapes: a parabolic body of revolution, a Sears-Haack body, and a von Kármán ogive body. Both symmetrically mounted circular-section bodies and bottom-mounted semicircular-section bodies were tested. The tests were conducted at a Mach number of 3.0 and at a Reynolds number, based on the wing reference chord, of 2.6×10^6. Angle of attack was varied from −4° to 11° Author

N66-39608*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LONGITUDINAL AERODYNAMIC CHARACTERISTICS AT MACH NUMBER 2.02 OF A SERIES OF WING-BODY CONFIGURATIONS EMPLOYING A CAMBERED AND TWISTED ARROW WING
Harry W. Carlson Washington, NASA, Jul. 1963 19 p refs
(NASA-TM-X-838) CFSTI: HC $1.00/MF $0.50 CSCL 01A
(Declassified)

The investigation employed at 70° swept arrow wing of aspect ratio 2.24 and was performed in the Langley 4- by 4-foot supersonic pressure tunnel at a Mach number of 2.02 and a Reynolds number of 4.4×10^6 based on the mean aerodynamic chord. Each of the seven configurations tested had the same distribution of normal cross-sectional areas but had different body center-line incidence and camber. Author

N66-39611*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANALYTICAL INVESTIGATION OF THE REENTRY BEHAVIOR OF THE "FLYING WIND TUNNEL" TEST VEHICLE, WITH SOME EFFECTS OF THRESHOLD AND TORQUE LEVEL OF A ROLL-RATE CONTROL SYSTEM
Byron M. Jaquet and Herman S. Fletcher Washington, NASA, Jul. 1962 75 p refs
(NASA-TM-X-697) CFSTI: HC $2.50/MF $0.75 CSCL 01A

Results are presented of an analytical investigation of the effects of various initial conditions on the dynamic behavior of the "flying wind tunnel" test vehicle for an altitude range of 400,000 to 130,000 feet. Included in the investigation were the effects on behavior of the vehicle of initial angle of attack (0°, 3°, and 10° investigated, with emphasis on 10°), center-of-gravity offset, model support pylon misalinement, roll rate, and threshold and torque level of an on-off reaction roll-rate control system. The six-degree-of-freedom calculations were made for a spherical nonrotating earth with the 1956 ARDC atmosphere and were made on an IBM 7090 electronic data processing system. Author

N66-39620*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
WING-BODY COMBINATIONS WITH WINGS OF VERY LOW ASPECT RATIO AT SUPERSONIC SPEEDS
Leland H. Jorgensen and Elliott D. Katzen Washington, NASA, 26 Oct. 1956 62 p refs
(NACA-RM-A56G16) CFSTI: HC $2.50/MF $0.75 CSCL 01A
(Declassified)

The results of an investigation to determine the aerodynamic characteristics of missiles employing wings of very low aspect ratio (1 and less) are presented. Data for Mach numbers of 1.97 and 3.33 and a Reynolds number of about 9×10^6 (based on body length) are discussed. Comparisons of theory with experiment are made. Author

N66-39621*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE CHARACTERISTICS OF AN UNDERSLUNG VERTICAL-WEDGE INLET WITH POROUS SUCTION AT MACH NUMBERS OF 0.63 AND 1.5 TO 2.0
John L. Allen and Thomas G. Piercy Washington, NASA, 3 Aug. 1956 51 p refs
(NACA-RM-E56B15) CFSTI: HC $2.50/MF $0.50 CSCL 01A
(Declassified)

Removing 3 to 6 percent of the maximum inlet mass flow through the porous wedge increased the effective thrust ratio 3 to 5 percent of ideal thrust at Mach numbers of 1.5 and 2.0, respectively. Angles of attack between ±4° had little effect. Increasing the angle of yaw from 0° to 6°, however, seriously decreased the effective thrust ratio. Total-pressure distortion at the compressor inlet decreased from 16 to 6 percent as the Mach number increased from 1.5 to 2.0. The use of wedge static-pressure orifices to provide an input signal for a normal-shock-positioning wedge-angle control indicated that for the zero-yaw condition net-thrust-minus-drag could be maintained with 1 percent of the optimum value. Author

N66-39622*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SOME EFFECTS OF FLOW SPOILERS AND OF AERODYNAMIC BALANCE ON THE OSCILLATING HINGE MOMENTS FOR A SWEPT FIN-RUDDER COMBINATION IN A TRANSONIC WIND TUNNEL
Robert W. Herr, Frederick W. Gibson, and Robert S. Osborne Washington, NASA, 28 May 1958 36 p refs
(NACA-RM-L58C28) CFSTI: HC $2.00/MF $0.50 CSCL 01A
(Declassified)

Forced-oscillation tests were made in the Langley 8-foot transonic pressure tunnel to investigate some effects of an overhang-type aerodynamic balance and of flow spoilers. Dynamic hinge moments were measured on a full-span flap-type rudder on a 5-percent-thick, swept vertical fin of low aspect ratio. Rudder hinge moments were measured over a Mach number range of 0.60 to 1.20 at a constant oscillating amplitude of ±2.5°. Experimental results showed both the aerodynamic balance and the flow spoiler to have a beneficial effect on the aerodynamic hinge-moment damping coefficient at transonic speeds. Author

N66-39760# ARO, Inc., Arnold Air Force Station, Tenn.
IDEAL GAS SPHERICALLY BLUNTED CONE FLOW FIELD SOLUTIONS AT HYPERSONIC CONDITIONS
J. F. Roberts, Clark H. Lewis, and Marvin Reed Arnold Eng. Develop. Center, Aug. 1966 48 p refs
(Contract AF 40(600)-1200)
(AEDC-TR-66-121; AD-637703) CFSTI: HC $2.00/MF $0.50

Charts of surface pressures, Mach number, and Reynolds number distributions over spherically blunted cones in an ideal gas (gamma = 1.4) are presented in the ranges M = 8 to 30 and cone half-angles 0 to 20 deg. The pressure data are correlated and compared with a previous empirical correlation of experimental data. The difference in numerical results and empirical correlation of surface pressures is attributed to the viscous-induced pressure increment in the experimental data Author (TAB)

N66-39815# National Aerospace Lab., Tokyo (Japan).
THE CAMBER DISTRIBUTION OF A SPANWISE UNIFORMLY LOADED SUBSONIC WING
Toshio Kawasaki and Masao Ebihara 1966 25 p refs In JAPANESE; ENGLISH Summary
(NAL-TR-104) CFSTI: HC $1.00/MF $0.50

The shape of three-dimensional wings in the subsonic flow, with load distribution uniform of spanwise- and arbitrary in chordwise direction is discussed. A certain restriction has to be placed on the planform of the wing; the wing, swept-back or not, should have straight leading- and trailing edges. Formulae, derived from linearised theory, are given with which one can obtain the camber shape from predetermined load distribution. In addition, presented is an expression for calculating the Mach number distribution normal to the isobars on the wing surface. Some numerical examples show that the advent of the critical stage on the wing surface will be delayed up to a considerably high uniform-stream Mach number by means of designing the camber shape for the wing in such a manner that it possesses spanwise uniform loading with a suitable chordwise shape of distribution. Author

N66-39817# National Aeronautical Lab., Bangalore (India).
HYPERSONIC FLOW AROUND A BLUNT BODY: REAL GAS EFFECTS
N. R. Subramanian and G. S. Dwarakanath Apr. 1966 15 p refs
(TN-AE-30-66) CFSTI: HC $1.00/MF $0.50

This paper deals with the real gas effects of the hypersonic flow over a cylinder with a blunt nose. The analysis is made using the Lighthill model of an ideal dissociating gas in equilibrium. The real gas effects on the high entropy layer adjacent to the body due to the curvature of the detached shock in front of the blunt nose have been evaluated for the cases $M_\infty = 40$ & $M_\infty = 22$ at different altitudes, using pure oxygen as flowing media. The density profiles and the dissociation levels at various distances from the nose have been plotted. The proportion of oxygen atoms remains considerable up to relative distances $x/d = 0(100)$ where d is the diameter of the nose base. It is found that a significant portion of the energy of the shock heated gas goes to dissociate the oxygen molecules and the quantitative evaluation of this energy has been carried out. Author

N66-39831# Royal Aircraft Establishment, Farnborough (England).
THE FUNCTIONING OF AN INTERNAL BOUNDARY LAYER BLEED ON AN EXTERNAL COMPRESSION SUPERSONIC AIR INTAKE [FONCTIONNEMENT DU PIEGE A COUCHE LIMITE INTERNE D'UNE PRISE D'AIR A COMPRESSION SUPERSONIQUE EXTERNE]
J. Leynaert Jun. 1966 16 p Transl. into ENGLISH of ONERA Rept. TP-288, 1965 Presented at the AGARD Specialists' Meeting on Aerodyn. of Power Plant Installation, Tullahoma, Tenn., 25–27 Oct. 1965 Submitted for Publication
(RAE-LIB-TRANS-1173) CFSTI: HC $1.00/MF $0.50

The structure of the flow in an air intake with external supersonic compression, a low cowl slope, and an internal boundary layer bleed does not have the classical pattern of a supersonic compression terminated by a normal shock. In fact the shock is oblique and in the region of the bleed a transonic expansion is produced. The bleed flow is concentrated into a jet which reattaches on to the leading edge of the subsonic diffuser and its amount depends on the engine flow. When this decreases bleed flow increases so acting as an automatic bypass and avoiding subcritical operation of the intake. Detailed description of the phenomenon enables one to explain the overall characteristics of the air intake and obtain more easily a flow of optimum efficiency and uniformity at the diffuser exit. Author

N66-39832# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.
EXPERIMENTAL STUDY OF SINGLE DEGREE-OF-FREEDOM FLUTTER IN TRANSONIC FLOW [ETUDE EXPERIMENTALE DES FLOTTEMENTS A UN DEGRE DE LIBERTE EN ECOULEMENT TRANSSONIQUE]
Henri Loiseau 1966 50 p refs In FRENCH; ENGLISH summary
(TN-95(1966)) CFSTI: HC $2.00/MF $0.50

This investigation concerns a wing with aileron. Three types of instability are shown to exist. They are found when the shock-wave is ahead of the hinge, the shock-wave is on the aileron, and when the shock-wave is attached at the aileron trailing-edge. These three types are found in different Mach number ranges. For each type the Reynolds number and aspect-ratio effects are studied. The work has not been extended to thick wings or to high frequency parameters. Author

N66-39867*# ARO, Inc., Arnold Air Force Station, Tenn.
HYPERSONIC STATIC STABILITY INVESTIGATION OF A TOMAHAWK 20-PERCENT-SCALE MODEL Technical Report, 27 May–2 Jun. 1966
Glenn H. Marz Arnold Eng. Develop. Center, Aug. 1966 20 p Sponsored in part by NASA
(Contract AF 40(600)-1200)
(NASA-CR-79201; AEDC-TR-66-148; AD-637698) CFSTI: HC $1.00/MF $0.50 CSCL 01A

An experimental investigation was conducted to obtain detailed static stability, induced roll and yaw, and roll forcing information on several configuration of a Tomahawk 20-percent-scale model. Tests were conducted at nominal Mach numbers of 6 and 8, free-stream Reynolds numbers of 2,500,000 and 5,000,000 per foot, angles of attack from -2 to 14 deg, and roll angles from 0 to 90 deg. Selected results are presented to illustrate types and quality of data obtained Author (TAB)

N66-39883# Lockheed Missiles and Space Co., Palo Alto, Calif.
NONSTATIONARY SUPERSONIC FLOW AROUND BLUNT BODIES WITH A DETACHED SHOCK
G. G. Telenin and Iu. M. Lipnitskii [1966] 13 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. i Gaza (USSR), no. 4, 1966 p 19–29 CFSTI: HC $1.00/MF $0.50

A numerical method analyzing the supersonic three-dimensional flow around blunt bodies with a detached shock was applied to the case of nonstationary flow. Consideration is given to two fundamental questions that arise in the analysis of the formulation of the problem, i.e., (1) whether the assumed conditions are sufficient for the smallness of the nonstationary perturbations and (2) whether the propagation of the small perturbations in the transonic domain beyond the shock is linear, and whether it is described by linear equations obtained by linearizing the complete nonlinear system of gasdynamic equations. Fundamental equations are given, and the results are compared with results obtained by Newtonian theory. L.E.W.

N66-39939# Pratt and Whitney Aircraft, West Palm Beach, Fla. Florida Research and Development Center.
SINGLE STAGE EXPERIMENTAL EVALUATION OF SLOTTED ROTOR AND STATOR BLADING. PART II: ANNULAR CASCADE INVESTIGATION OF SLOT LOCATION AND GEOMETRY 31 Oct. 1966 77 p refs
(Contract NAS3-7603)
(NASA-ER-54545; PWA-FR-1669) CFSTI: HC $3.00/MF $0.75 CSCL 01A

An annular cascade investigation was conducted to provide criteria for the design of slotted rotors and stators to be tested in a subsequent part of the overall program. The test stators were 65-series airfoils, having a chord length of 6.5 inches and a calculated midspan D-factor loading of 0.528 without slots. A slot located approximately midway between the point of minimum pressure and the point of separation produced the best performance, reducing the wake loss coefficient to about 17% of that for the unslotted vane and increasing the lift coefficient and air turning angle approximately 10% and 2 degrees, respectively. Author

N66-39964# RAND Corp., Santa Monica, Calif.
SUPERSONIC INTERFERENCE FLOW ALONG THE CORNER OF INTERSECTING WEDGES
A. F. Charwat and L. G. Redekopp Jul. 1966 56 p refs
(Contract AF 49(638)-1700; Proj. RAND)
(RM-4863-PR; AD-637614) CFSTI: HC $3.00/MF $0.50

An experimental investigation of the inviscid supersonic flow field in a corner formed by two intersecting wedges is reported. The study includes measurements of the distribution of the surface pressure and the wave structure of the flow field in the corner region both for a symmetrical corner configuration (i.e., equal wedge angles) in the Mach-number range between 2.5 and 4 and for an asymmetrical model at one Mach number as a function of the incidence angle of one wedge. A clearly identifiable shock structure is discovered that divides the interference field into four zones. The total extent of the disturbance near the surfaces of the model is approximately twice the extent indicated by available small-perturbation analyses. The highest pressure rise occurs in the inner zone near the corner; the magnitude of this rise is related successfully to the second-order linearized theory. The inviscid flow field is shown to involve strong cross-stream pressure and entropy gradients both at the corner proper and away from it, which cannot be disregarded in analyses of the viscous boundary layer. Author (TAB)

N66-39988*# General Applied Science Labs., Inc., Westbury, N.Y.

ANALYTICAL STUDY OF AERODYNAMIC MEANS OF CONTROLLING SUPER SONIC INLET FLOW, PART I Technical Report 495B

H. Rosenbaum and S. L. Zeiberg Nov. 1965 34 p refs (Contract NAS1-4387) (NASA-CR-66209) CFSTI: HC $2.00/MF $0.50 CSCL 01A

There is presented herein a method of achieving a variable geometry inlet without recourse to mechanical devices. The principles of viscous mixing and basic inviscid fluid mechanics are combined by utilizing mass flow injected along the wall of an inlet to provide the desired area changes. For this purpose an analysis for a two-dimensional turbulent jet mixing into an adverse pressure gradient field is presented and numerical solutions for conditions of interest are discussed. It is shown that the basic scheme is a sound one; its drawbacks are discussed and improvements suggested. Author

N66-39989*# General Applied Science Labs., Inc., Westbury, N.Y.

ANALYTICAL STUDY OF AERODYNAMIC MEANS OF CONTROLLING SUPERSONIC INLET FLOW, PART II Technical Report No. 496E

H. Rosenbaum and S. L. Zeiberg Mar. 1966 43 p refs (Contract NAS1-4387) (NASA-CR-66210) CFSTI: HC $2.00/MF $0.50 CSCL 01A

A method for achieving variable geometry inlets, by aerodynamic means, for high supersonic Mach numbers is presented. The scheme discussed makes use of fixed passages in the inlet walls to inject air at some angle to the main inlet flow in order to achieve the desired compressions. The injected air is then trapped and recirculated. A typical inlet has been designed for operation at Mach numbers 2, 2.5, and 3.0 taking into account both the inviscid interaction of the jets and main stream and the viscous mixing between the two. Calculations are also performed to estimate the costs in terms of drag and propulsion efficiency of this design. These drawbacks are seen to be small and the overall simplicity of this system when compared to standard variable geometry inlets suggests further investigation, on a laboratory scale, of this inlet design. Author

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N66-39254# Research Inst. of National Defence, Stockholm (Sweden) Uppsala Ionospheric OSS.

INFLATABLE MYLAR PARACHUTES FOR HIGH ALTITUDES

A. Pedersen *In its* Rocket Expt. for Studies of D-Region Ion Concentration and Emission from Released Chem. in Twilight and Aurora 1966 p 45–59 ref (See N66-39251 24-13)

An inflatable parachute system has been developed for deceleration of an ionospheric probe instrumentation descending from 80-100 km height after expulsion from a Booster Arcas rocket. The inflation of the parachute is achieved by means of a torus fastened close to the leading edge of the parachute. The torus can be blown up with residual air or with water vapour. Some constructional details of the parachute and expulsion mechanism are included in this report. The parachute behavior after expulsion is also discussed, and descent rates are calculated. The parachute performance is described. Author

N66-39441*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EXPLORATION FLIGHT INVESTIGATION AND ANALYSIS OF STRUCTURAL LOADS ENCOUNTERED BY A HELICOPTER HINGELESS ROTOR SYSTEM

John F. Ward Washington, NASA, Nov. 1966 46 p refs (NASA-TN-D-3676) CFSTI: HC $2.00/MF $0.50 CSCL 01C

The rotor used in the flight program was an experimental three-blade hingeless rotor on an OH-13G helicopter. The basic dynamic response characteristics of the hingeless rotor system are reviewed to provide a background for the discussion and analysis of the structural loadings encountered in flight. At normal rotor rotational speed the centrifugal-force field provides approximately 95% of the cantilever-blade stiffening in the flapwise degree of freedom. Thus, the cantilever blade deflects in the first flapwise mode an amount virtually equal to a hinged blade and simultaneously provides rotor-hub moments which are an order of magnitude greater than those obtainable from a typical hinged rotor system. The structural load of most concern, for a hingeless rotor utilizing blades of conventional design, is the buildup of the blade cyclic chordwise bending moment in manuevering flight throughout the speed range. A simplified analysis of the hingeless-rotor blade root bending moments is developed and compared with measured data. This analysis makes use of the virtual offset untwisted blade with spring restraint to approximate the response of the actual cantilever blade. Only the aerodynamic effects of twist are included in the analysis. A conventional offset blade analysis can be utilized provided that the proper virtual spring restraint is used at the flapping and lagging hinges. Author

N66-39479# Aviation Safety Engineering and Research, Phoenix, Ariz.

PRINCIPLES FOR IMPROVING STRUCTURAL CRASH WORTHINESS FOR STOL AND CTOL AIRCRAFT

William H. Reed and James P. Avery Ft. Eustis, Va., Army Aviation Mater. Labs., Jun. 1966 73 p refs (Contract DA-44-177-AMC-254(T)) (AvSER-65-18; USAAVLABS-TR-66-39; AD-637133) CFSTI: HC $3.00/MF $0.75

The area of crash behavior analysis of aircraft structures is investigated. The investigation begins with the definition of two indices of crashworthiness of basic aircraft structures and the analysis of the influence of several general types of structural modifications upon these two indices. This analysis, using fundamental principles of mechanics, contains several simplifying assumptions, which are explained as they are introduced. Design concepts to improve the ability of the 'protective container' to maintain living space for occupants during a crash or to attenuate the accelerations experienced by occupants during a crash are developed for crash conditions which are either primarily longitudinal in nature or primarily vertical in nature. Analytical methods are then provided to show how and when to apply these design concepts to any particular aircraft. The principles which are presented are suitable for use during design of new aircraft as well as modification of existing aircraft. The results are presented from three full-scale crash tests of small twin-engine airplanes which were conducted as a part of this investigation. Author (TAB)

N66-39606*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

STABILITY AND CONTROL CHARACTERISTICS AT MACH NUMBERS OF 1.41 AND 2.20 OF A MULTIMISSION STOL AIRPLANE CONFIGURATION WITH A VARIABLE-SKEW WING

Gerald V. Foster Washington, NASA, May 1983 77 p refs (NASA-TM-X-812) CFSTI: HC $2.50/MF $0.75 CSCL 01C

The configuration consisted of a high-wing-body arrangement with twin side inlets and duct system. The wing had a 5-percent-thick trapezoidal planform with a pivot located at the

50-percent root chord. By rotating about the wing pivot the wing could be fixed at several skew angles ranging from 0° to 90°. The results were obtained through a range of angle of attack and sideslip angle from −4° to 15° Author

N66-39616*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STABILITY AND CONTROL CHARACTERISTICS AT A MACH NUMBER OF 1.41 OF A VARIABLE-SWEEP AIRPLANE CONFIGURATION CAPABLE OF LOW-LEVEL SUPERSONIC ATTACK-OUTER WING SWEPT 75° AND 108°
Ross B. Robinson and Paul W. Howard Washington, NASA, Aug. 1960 27 p refs
(NASA-TM-X-320) CFSTI: HC $2.00/MF $0.50 CSCL 01C
(Declassified)

Tests were made with various deflections of the horizontal tail for both outer wing-sweep angles and with the horizontal tail off for the 75° swept-wing configuration for an angle-of-attack range of about −6° to 13° and for a sideslip range of about −6° to 12° at various angles of attack. The effects of simulated ground-reflected shock waves were investigated for the configuration having the 108° swept wing. Author

N66-39617*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
ANALYSIS OF FLIGHT-DETERMINED AND PREDICTED EFFECTS OF FLEXIBILITY ON THE STEADY-STATE WING LOADS OF THE B-52 AIRPLANE
Albert E. Kuhl, John T. Rogers, and Mary V. Little Washington, NASA, 23 Apr. 1958 62 p ref
(NACA-RM-H57C25) CFSTI: HC $2.50/MF $0.75 CSCL 01C
(Declassified)

An analysis is made of the steady-state wing loads measured during a flight investigation conducted on the Boeing B-52 airplane. The investigation covers the speed range of the airplane up to a Mach number of 0.90. The measured loads are analyzed in terms of the effects of Mach number, lift, and dynamic pressure. In addition, the measured loads are compared with predicted loads and the effects of varying some of the structual and aerodynamic properties in the predictions are presented. Author

N66-39629# Biotechnology, Inc., Arlington, Va.
PROTOTYPE SPECIFICATION FOR THE PREPARATION OF FLIGHT MANUALS Final Report, Jul. 1964–Jun. 1966
Theodore J. Post, James F. Parker, Jr., and Leon T. Bonner Port Washington, N. Y., Naval Training Device Center, Jun. 1966 179 p
(Contract N61339-1638)
(NAVTRADEVCEN-1638-1; AD-637200) CFSTI: HC $5.00/MF $1.00

Contents: Aircraft indoctrination, Aircraft description, Indoctrination program, Systems descriptions, Flight operations, Flight characteristics, Flight procedures, Operating limitations, Performance data, Standardization evaluation. TAB

N66-39649# Flight Safety Foundation, Inc., Phoenix, Ariz. Aviation Safety and Research Div.
UNITED STATES ARMY AVIATION CRASH SURVIVAL RESEARCH Summary Report, Oct. 1964–Sep. 1965 Jun. 1966 32 p refs
(Contract DA-44-177-AMC-254(T))
(AvSER-65-12; USAAVLABS-TR-66-43; AD-637132) CFSTI: HC $2.00/MF $0.50

Analysis of U. S. Army aircraft accidents has revealed that accelerative loads on impact have been well within the limits of human tolerance in the majority of cases. Personnel involved in these accidents, however, have frequently suffered serious or fatal injuries as a result of the failure of some portion of the aircraft structure (e.g., crushing of fuselage), failure of some major component (e.g., crew seat), or postcrash fire. Accordingly, the major emphasis in the projects conducted during the contract year was on improved structural crashworthiness, improved crash survival capability in seats and retention systems, and improved fuel containment in dynamic crash environments. The objectives of the work effort in general was to develop more realistic crash survival design criteria for existing and future U. S. Army aircraft. In addition to the areas cited above, effort continued in the areas of crash survival investigators training, field investigation of pertinent aircraft accidents, and scientific liaison. All major work areas are reported in summary form Author (TAB)

N66-39905*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
AN EVALUATION OF THE HANDLING QUALITIES OF SEVEN GENERAL-AVIATION AIRCRAFT
Marvin R. Barber, Charles K. Jones, Thomas R. Sisk, and Fred W. Haise Washington, NASA, Nov. 1966 58 p refs
(NASA-TN-D-3726) CFSTI: HC $2.50/MF $0.50 CSCL 01C

A quantitative and qualitative flight-evaluation program has been conducted on seven late-model general-aviation aircraft. The quantitative portion of this program indicated that the aircraft, as a class, have generally satisfactory stability and control characteristics. However, these characteristics are degraded with decreasing airspeed, increasing aft center of gravity, increasing power, and extension of gear and flaps. The qualitative portion of the program showed that the handling qualities are generally satisfactory during visual flight and during instrument flight in smooth air. Atmospheric turbulence degrades these handling qualities, with the greatest degradation noted during instrument landing system approaches. Such factors as excessive control-system friction, low levels of static stability, high adverse yaw, poor Dutch roll characteristics, and control-surface float combine to make precise instrument tracking tasks, in the presence of turbulence, difficult even for experienced instrument pilots. The program revealed three characteristics of specific airplanes that are considered unacceptable if encountered by the inexperienced or unsuspecting pilot: (1) a violent elevator force reversal at reduced load factors in the landing configuration, (2) power-on stall characteristics that culminate in rapid rolloffs and/or spins, and (3) neutral-to-unstable static longitudinal stability at aft center of gravity. Author

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N66-39053# Federal Aviation Agency, Washington, D. C. Systems Research and Development Service.
MODULAR SOLID STATE UNINTERRUPTIBLE POWER SYSTEM Final Report
Alexander Kusko Sep. 1966 51 p refs
(RD-66-61)

Details are given on how the requirements for a Modular Solid State Uninter ruptible Power System (UPS) can be met using available solid-state-circuit and inverter techniques. Each module will consist of a rectifier–battery–inverter assembly capable of operating from either commerical power, standby generators or internal battery power, and delivering continuous, uninterruptible, regulated, three-phase ac power to its loads. The UPS must be designed so that each module of a typical four-module system will have an MTBF of the order of 1,100 hr and an MTTR of 1 hr to meet the system MTBF requirement of 100,000 hr. The

UPS must also be designed so that the output voltage during all switching and fault clearing operation falls within a voltage–time envelope that the electronic load equipment can tolerate. Author

N66-39453# Sonotone Corp., Elmsford, N. Y.
R&D CONTRACT FOR THE DEVELOPMENT OF A 20-CELL FIBERGLAS CASED BB501()/U BATTERY Final Report, 30 Jun. 1965–15 Mar. 1966
John Herrmann, Arthur Fitchman, and Elmer A. D'Onofrio Ft. Monmouth, N. J., Army Electron. Command, Jul. 1966 144 p (Contract DA-28-043-AMC-00222(E))
(ECOM-00222-F; AD-637157) CFSTI: HC $4.00/MF $1.00

This report covers the research and development activities which have been directed towards the design of a 24-volts, vented, nickel-cadmium battery housed in a reinforced fiberglas container and capable of surviving four-foot free fall drops. Essentially, the structural system consists of a steel inner box which clamps two banks of 10 cells each to make a rigid assembly. This assembly, in turn, is hard-mounted within a reinforced fiberglas outer box to cause its walls to be preloaded in tension. This preload tends to reduce the magnitude of compressive loads induced by impact Author (TAB)

N66-39595# Sonotone Corp., Elmsford, N. Y.
STANDARD LINE-BATTERY ASSEMBLY BB-610()/U NICKEL CADMIUM VENTED Quarterly Report No. 3, 29 Jan.–28 Apr. 1966
John Herrmann, Arthur Fitchman, Raymond Nathe, and E. A. D'Onofrio Ft. Monmouth, N. J., Army Electron. Command, Jul. 1966 97 p
(Contract DA-28-043-AMC-01508(E))
(ECOM-01508-3; AD-637156) CFSTI: HC $3.00/MF $0.75

The report covers the research and development activities which have been directed towards the design of a 12-volt, vented, nickel-cadmium battery housed in a reinforced fiberglas container and capable of surviving four-foot, free-fall drops. Based upon our test results, certain modifications on the container were made, subsequently followed by a new series of drop tests. These test results proved out the acceptability of the new modifications, since no significant damage to the container was found at the end of 26 completed drops Author (TAB)

N66-39739# Union Carbide Corp., Parma, Ohio. Technical Center.
MINIATURE HYDROGEN GENERATOR Final Report, 1 Jun. 1965–30 May 1966
Jack E. Rothfleisch and Lawrence M. Litz Ft. Monmouth, N. J., Army Electron. Command, Aug. 1966 132 p refs *Its* Rept.-4 (Contract DA-28-043-AMC-01375(E))
(ECOM-01375-F; AD-637242) CFSTI: HC $4.00/MF $1.00

Pertinent engineering considerations are analyzed with regard to the feasibility of construction of miniature hydrogen generators using field-available fuels in processes such as high and low pressure steam reforming, high and low pressure partial oxidation and thermal cracking. The thermal cracking approach appears to be the best choice for systems in the size range of interest, that needed to supply hydrogen for 10 to 200 watt fuel cells. Experimental studies with both electrically heated tube furnaces and fuel-fired reactors have established the feasibility of the thermal cracking concept using either JP-4 or combat gasoline. Hydrogen concentrations in the product gas ranged from 80 to 95% at temperatures from 1050 to 1200C. Methane was the only detectable diluent at these temperatures. Sulfur compounds, arising from the sulfur in the feed stocks, were completely removed by a simple steel wool filter-scavenger pad in the reactor. Operation of alkaline electrolyte fuel cells on this product showed no deleterious effects. A variety of baffle geometries were tested to establish design fundamentals in terms of the optimum use of the reactor volume before plugging occurred due to the carbon accumulation and to optimize the product composition. Nickel and Inconel were established as suitable materials of construction. Preliminary efforts at burner development have led to a comparatively quiet, simple unit. A suggested design for a laboratory prototype system is presented Author (TAB)

N66-39758# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INFLUENCE OF STRUCTURAL CHANGES OF A RADIAL-AXIAL HYDROTURBINE ON ITS CAVITATION
I. V. Kotenev and K. K. Shal'nev 1 Apr. 1966 31 p refs Transl. into ENGLISH from Zh. Prik. Mekhan. i Techn. Fiz. (Moscow), no. 5, 1961 p 26–38
(FTD-MT-65-499; TT-66-62117; AD-637444) CFSTI: HC $2.00/MF $0.50

In bushing cavitation one can include: (a) bushing diffusion cavitation; (b) bushing cavitation of irregularities of the bushing surface; (c) bushing cavitation of discharge holes and (d) bushing axial cavitation, caused by rotation of the flow. In turbines without discharge holes in the bushing, the most dangerous with respect to the appearance of cavitation will be cavitation due to irregularities on the surface of the bushing. In turbines with discharge holes the most dangerous will be cavitation of the discharge holes, appearing during flowing around of the inlet edges of the holes. Zones of various forms cavitation take different forms during their propagation in the draft tube. During normal exit, even outside the region of optimum eta, the zone of cavitation disintegrates in the flow into separate bubbles. During regimes with swirling outflow, trains of zones cavitation on the bushing merge into filaments and are drawn closer to the axis of rotation of the column of liquid in the draft tube. But the axis of rotation of filaments does not coincide with the axis of the tube, as a consequence of which spiral filaments are formed Author (TAB)

N66-39872# European Space Technology Center, Delft (Netherlands).
ON A CORRECTION TO THE SOLAR CELL EQUATION
M. Janes 15 Mar. 1966 10 p refs
(E15/MJ)

Based on the published measurements of the temperature dependence of solar cells, as well as on physical reasons, a correction to the solar cell equation is proposed. A mathematical verification of the temperature characteristic is presented. Experimental verification of an equation which describes the emf dependence on temperature is given by investigating the solar cell's temperature dependence in a dark vacuum chamber. An equation which showed that the dependence of the short circuit current on temperature may be expressed by a parabola with negative signs was also experimentally verified. M.G.J.

N66-39890*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL FEASIBILITY STUDY OF WATER-FILLED CAPILLARY-PUMPED HEAT-TRANSFER LOOPS
Francis J. Stenger Washington, NASA, Nov. 1966 34 p refs (NASA-TM-X-1310) CFSTI: HC $2.00/MF $0.50 CSCL 10A

Two capillary-pumped heat-transfer loops were fabricated and tested to study their general characteristics. With water as a working fluid, the loops were operated over a power input range from 248 to 1000 watts in a temperature range from 212° to 291°F. The first loop, with a vapor duct 0.193 inch in inside diameter, was 70 feet long and operated at a maximum power input of 823 watts. The second loop (0.180-in. i.d. vapor duct) was 52 feet long and operated at 700 watts in a variety of orientations with respect to gravity. Although capillary-pumped loops must be designed with care to prevent problems with noncondensable gas, the test results show that such loops can transfer

kilowatts of heat over distances greater than 50 feet. The operation of the final test loop was not sensitive to its orientation with respect to gravity. Author

N66-39936*# Electro-Optical Systems, Inc., Pasadena, Calif.
HYDROGEN-OXYGEN ELECTROLYTIC REGENERATIVE FUEL CELLS Quarterly Report, 1 Jul.–30 Sep. 1966
M. Klein 15 Oct. 1966 42 p
(Contract NAS3-2781)
(NASA-CR-72110; EOS-4110-QL-9) CSCL 10A

Emphasis was placed on the testing of single cells with various electrode and matrix structures to improve cycle life capabilities and to obtain a better understanding of modes of deterioration of cell performance. Single-cell life of 952 cycles was achieved with a 90% potassium titanate-10% asbestos matrix. This was the longest operational life achieved to date. Gradual degradation in performance is still observed; this may be caused by the 10% asbestos constituent. Attempts to substitute another inert fiber material for the asbestos resulted in cross gas leakage. An alternate approach for the matrix which utilizes a gas barrier membrane sandwiched between two layers of absorbent material offers a possible solution ot the recombination problem and thus may enable longer cycle life Author

N66-39944*# Naval Ammunition Depot, Crane, Ind.
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION SPACE CELL TEST PROGRAM Monthly Progress Report, 1–30 Sep. 1966
E. R. Pettebone 19 Oct. 1966 157 p
(NASA Order W-11252-B)
(NASA-CR-79083) CFSTI: HC $5.00/MF $1.00 CSCL 10A

Reported are the results of life cycle tests conducted with electrochemical cell packs during September of 1966 as part of a NASA program. The following cell types were tested: nickel-cadmium, silver-cadmium, and silver-zinc. The cells were in 5-cell and 10-cell packs. Test parameters were ambient temperature, voltage limits per pack on charge, depth of discharge, and orbit time. An outline is given of the capacity test procedure. A data recording schedule for the cycle intervals is explained. Cells from several manufacturers were tested. Detailed test results and failure analyses are presented in tables. K.W.

N66-39957*# Naval Ammunition Depot, Crane, Ind.
[SPACE CELL TEST PROGRAM] Monthly Progress Report, Period Ending 31 Aug. 1966
(NASA Order S-23404-G) 22 Sep. 1966 155 p
(NASA-CR-79084) CFSTI: HC $5.00/MF $1.00 CSCL 10C

Tabulated results are presented of life cycle tests conducted during this period on five and ten cell packs of nickel-cadmium, silver-cadmium, and silver-zinc cells. Included are data on pack failures, capacity tests, and other operating characteristics. R.N.A.

N66-39958*# TRW Systems, Redondo Beach, Calif.
STUDY AND ANALYSIS OF SATELLITE POWER SYSTEMS CONFIGURATIONS FOR MAXIMUMUTILIZATION OF POWER *Fifth Quarterly Progress Report*, 18 May–18 Jul. 1966
J. G. Leisenring [1966] 54 p
(Contract NAS5-9178)
(NASA-CR-79085; E-7061.2-252) CFSTI: HC $3.00/MF $0.50 CSCL 10B

All power conditioning parametric data was updated. Results of the improved state of the art designs are reported as functions of the various design parameters. New methods and design techniques for improving power systems performance, weight, efficiency, and/or reliability were analyzed to determine the extent of their application. Selected circuit designs were parametrically analyzed to determine their optimum operating limits and tradeoff factors. The dc-to-dc converter was chosen as the study model. A common converter requirement specification was selected to meet typical conversion requirements. Three basic circuits were analyzed: regulated squarewave converter, pulsewidth converter, and energy storage converter. Data related to each circuit design was derived for weight and efficiency as functions of output power and switchingfrequency. The final converter parametric data is the result of synthesizing the applicable groups of data derived for each major section of the converter circuit. R.N.A.

N66-39971*# Aerojet-General Corp., Azusa, Calif. Von Karman Center.
SNAP-8 ELECTRICAL GENERATING SYSTEM DEVELOPMENT PROGRAM Semiannual Progress Report, 1 Jul.–31 Dec. 1965 Mar. 1966 241 p refs *Its* Rept.-3137
(Contract NAS5-417)
(NASA-CR-72085) CFSTI: HC $3.75/MF $1.25 CSCL 10B

SNAP-8 is a turboelectric, nuclear, space power conversion system using a mercury Rankine cycle. The system incorporates three liquid metal loops. Sodium-potassium (NaK) in the primary loop is heated in a reactor, and in turn heats mercury in a heat exchanger. The mercury vapor, in the second loop, expands through a turbine; it is then condensed and pumped back through the boiler. A third loop, also containing NaK, trans fers the heat from the mercury to a radiator where it is rejected to space. The fourth loop contains a polyphenyl ether that lubricates the bearings of the main rotating components and provides necessary cooling forthe alternator, electric motors, and controls. This report covers the progress in development of the SNAP-8 power conversion system and system components during the last half of 1965. Author

N66-39985*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL STUDY OF EFFECTS OF ELECTRON IRRADIATION FROM 20 KEV TO 1 MEV ON A POLYETHYLENE TEREPHTHALATE CAPACITOR-TYPE METEOROID DETECTOR
Thomas G. James, Harry H. Heyson, and Clifford S. Frank Washington, NASA, Nov. 1966 29 p refs
(NASA-TN-D-3682) CFSTI: HC $2.00/MF $0.50 CSCL 14B

A capacitor-type meteoroid detector was irradiated with low-energy electrons. Under irradiation, this detector produced pulses which were counted in a satellite-type detection circuit. At liquid-nitrogen temperature, the number battery voltage (over a range from 0 to 135 V) and the electron dose rate (over a range from 3.1×10^{7} e/cm^2-sec to 3.1×10^{10} e/cm^2-sec). The greatest number of pulses was observed at liquid- nitrogen temperature (77°K). The number of pulses decreased with increasing temperature; however, radiation-induced pulses still occurred at temperatures on the order of 363° K. It is believed that the pulses were caused by electron charge storage and subsequent discharge within the polyethylene terephthalate dielectric of the detector. The results of a few preliminary tests of a coincidence-type detector, designed to discriminate against radiation pulses, are also presented. Author

N66-39995*# Naval Ammunition Depot,Crane, Ind.
ACCEPTANCE TEST OF QULTON INDUSTRIES 3.6 AND 5.6 AMPERE-HOUR NICKEL CADMIUM CELLS WITH VULCANIZED NEOPRENE TERMINAL SEALS
H. M. Schultz 28 Jan. 1966 27 p
(NASA Order W-11252-B)
(NASA-CR-79090; QE/C-66-69) CFSTI: HC $2.00/MF $0.50 CSCL 10C

Acceptance test results are presented for performance characteristics and limitations of 3.6 and 5.6 ampere-hour secondary spacecraft cells. Tests for these cells with valcanized neoprene terminal seals included: phenolphthalein leak, capacity, cell short, immersion seal, overcharge, and internal resistance. The vulcanized neoprene seals of these cells were proved satisfactory, and the weak point in cell construction was attributed to the cover to can weld. S.P.

N66-39996*# Unified Science Associates, Inc., Pasadena, Calif.
GASEOUS ELECTROLYTES FOR BATTERIES AND FUEL CELLS Eighth Quarterly Report, Period Ending 31 Jul. 1966
S. Naiditch [1966] 38 p
(Contract NAS7-326)
(NASA-CR-79087) CFSTI: HC $2.00/MF $0.50 CSCL 10A

From measurements made this quarter on cell 63, we have established that the cell emfs of sodium amalgam concentration cells are independent of whether the electrolyte is liquid or gaseous. Cell 63 was run to 145°C, about 10° above the critical temperature. Though lost at 55°C upon cooling, amalgam samples from three electrodes were recovered and analyzed, showing sodium concentrations of 15, 4.11 and 0.56 mole percent. The conclusion that the cell emf of sodium amalgam concentration cells is independent of electrolyte state is based on measurements of cells 58 and 63 and has been predicted from theoretical considerations. These measurements verify the results of the earlier analysis. Cell 69, a metal-amalgam insoluble-salt, was run to 100°C and cooled to room temperature. Its zinc and thallium electrodes were well enough behaved to allow observation of individual disturbances and to isolate their causes. In this cell, the two Tl(Hg)/$TlCl_2$ electrodes were both more unstable and less reversible than the two Zn(Hg)/$ZnCl_2$ electrodes. Author

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N66-38995# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
APPLICATION OF CORRELATION ANALYSIS METHODS TO STUDY OF THE REACTIONS OF THE HUMAN CARDIOVASCULAR SYSTEM IN SPACE FLIGHT ABOARD A "VOSKHOD" VEHICLE
A. D. Voskresenskiy and M. D. Venttsel' *In its* Cosmic Res., Vol. III, No. 6 [1966] p 198-211 refs (See N66-38986 24-30)
CFSTI: HC $6.00/MF $1.25

Segments containing 100-300 cardiac cycles were selected from telemetered ECG recordings from the three cosmonauts and used for calculating the autocorrelation and mutual correlation functions of the R-R and Q-T intervals. During the prelaunch period, all cosmonauts had shown slow undulating variations of R-R and Q-T with an oscillation period encompassing 56-64 cardiac cycles. The mutual correlation function of R-R and Q-T was approximately cosinusoidal in shape. In one case oscillations of the R-R with a period of 12-16 cardiac cycles were observed on the 14th orbit at the same pulse frequency as in the prelaunch phase. Here the Q-T interval showed practically no change, which indicates that the heart retains its efficiency under conditions of weightlessness. Slow R-R fluctuations of these types were not detected during sleep and rest periods. The slow R-R and Q-T fluctuations may be due to the influence of emotional factors on circulatory regulation. Author

N66-38998# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF KIDNEY FUNCTION IN THE CREW OF A "VOSKHOD" SPACECRAFT
Yu. V. Natochin, M. M. Sokolova, V. F. Vasil'yeva, and I.S. Balakhovskiy *In its* Cosmic Res., Vol. III, No. 6 [1966] p 212-219 refs (See N66-38986 24-30) CFSTI: HC $6.00/MF $1.25

The water-load method was used to investigate the water-excretion function of the kidneys of crew members. It was found that at the end of the second day after the flight, the organism's capacity for quick excretion of water drunk on an empty stomach was impaired. These changes are apperently related to readjustment of the endocrine regulation. No signs of injury to kidney tissue could be detected after the flight. Author

N66-39052# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
THE ORGANIC COOLANT FOR EURATOM'S ORGEL PROGRAM [LE REFRIGERANT ORGANIQUE DANS LE CADRE DU PROGRAMME ORGEL DE L'EURATOM]
J. C. Leny Brussels, EURATOM, Jun. 1966 24 p In FRENCH; ENGLISH summary Presented at the Panel on use of Org. Liquids as Reactor Coolants and Moderators, Vienna, 9-13 May 1966
(EUR-2996.f) CFSTI: HC $1.00/MF $0.50

The various stages of the main research areas covered under the Program, including basic research on such materials as organic coolant, uranium carbide, and SAP, and the construction of a zero-power reactor and of a test reactor, are briefly recapitulated. The organic liquid chosen was OM2, a mixture of terphenyl isomers in the following proportions: 22.5% ortho, 72.5% meta, and 5% para. This selection was arrived at on the basis of cost, melting point, and stability of the product. The main problems raised in connection with this coolant in relation to the project are outlined. It was concluded that terphenal mixtures are valid, and their use in conjunction with a uranium carbide fuel and SAP cladding makes it possible to reach very high specific powers. Author

N66-39054# Liege Univ. (Belgium). Labs. of Radiobiology.
CHEMICAL RADIOPROTECTIVE AGENTS [RADIOPROTECTEURS CHIMIQUES] Final Report, 1 Apr. 1964-31 Dec. 1965
Brussels, EURATOM, Jun. 1966 30 p refs In FRENCH; ENGLISH summary
(Contract EURATOM-048-64-3 BIOB)
(EUR-2992.f) CFSTI: HC $2.00/MF F$0.50

In order to provide a valid interpretation of chemical radioprotection phenomena in the entire mammal, it is essential to have a better knowledge of the pharmacology and especially the biochemical effects of sulphurated radioprotective agents. The fresh water weed *Nitella flexilis* is a highly suitable organism for certain radiobiological research. Thorough study has been carried out on the reactions of the skin of the mouse and the rat to X-rays and to radioprotectors, and research has been conducted on an Ehrlich tumor, humoral immunity, and grafting. Studies have been made on decay of free radicals after irradiation, effect of the water content, analysis of the thiol groups. It was found that cysteamine per os does not protect the mouse against continuous irradiation (Cs 137 sources). Author

N66-39100# Uppsala Univ. (Sweden). Inst. of Physiology.
RESEARCH ON THE GENESIS OF ACTION POTENTIAL IN EXCITABLE TISSUES Technical (Final) Report
Torsten Teorell 10 Jun. 1966 89 p refs
(Grant AF-EOAR-65-29)
(AFOSR-66-1510; AD-636349) CFSTI: HC $3.00/MF $0.75

The report describes research as follows: Investigations on a biophysical theory of physiological mechanoreceptors; A preliminary biophysical analysis of heart arrhythmias; Experiments on the excitability of the living heart; Investigations on the transport of ions and molecules in tightly cross-linked dextran gels. Author (TAB)

N66-39101# United Kingdom Atomic Energy Authority, Harwell (England). Authority Health and Safety Branch.
ACCIDENTAL EXPOSURES TO IONISING RADIATIONS
H. J. Dunster, K. P. Duncan, and G. W. Dolphin Jun. 1966 27 p refs
(AHSB(RP)-R-71) CFSTI: HC $2.00/MF $0.50

CONTENTS:

1. LESSONS TO BE DERIVED FROM SOME IRRADIATION ACCIDENTS IN THE UNITED KINGDOM H. J. Dunster and I. K. Legge p 1–9 (See N66-39102 24-04)

2. EARLY MEASURES IN THE CARE OF PERSONS ACCIDENTALLY OVEREXPOSED TO IONISING RADIATIONS K. P. Duncan p 10–12 (See N66-39103 24-04)

3. DOSE ASSESSMENT FOLLOWING ACCIDENTAL INTAKE OF RADIOACTIVE MATERIALS G. W. Dolphin p 13–20 refs (See N66-39104 24-04)

N66-39102# United Kingdom Atomic Energy Authority, Harwell (England). Authority Health and Safety Branch.

LESSONS TO BE DERIVED FROM SOME IRRADIATION ACCIDENTS IN THE UNITED KINGDOM

H. J. Dunster and I. K. Legge *In its* Accidental Exposures to Ionising Radiations Jun. 1966 p 1–9 (See N66-39101 24-04)

To prevent radiological accident injury, some selected radiation exposure incidents in the United Kingdom are investigated. It is considered that radiological accidents, whether or not they result in excessive doses or injuries, are a fruitful source of information and the lessons learned from them can be valuable, not only in preventing simple repetition of the accidents, but also in improving the overall control of radiological hazards. Lessons derived from the following types of accidents are listed: handling large radioactive sources, X-ray equipment, contamination control, reactor material removal, fires, and explosions. R.Li.

N66-39103# United Kingdom Atomic Energy Authority, Harwell (England). Authority Health and Safety

EARLY MEASURES IN THE CARE OF PERSONS ACCIDENTALLY OVEREXPOSED TO IONISING RADIATIONS

K. P. Duncan *In its* Accidental Exposure to Ionising Radiations Jun. 1966 p 10–12 (See N66-39101 24-04)

Therapeutic measures for substantial overexposure to ionizing radiation, and accidental ingestion of radioactive materials are outlined. External whole-body radiation exposures, and internal contamination are treated. R.Li.

N66-39104# United Kingdom Atomic Energy Authority, Harwell (England). Authority Health and Safety Branch.

DOSE ASSESSMENT FOLLOWING ACCIDENTAL INTAKE OF RADIOACTIVE MATERIALS

G. W. Dolphin *In its* Accidental Exposure to Ionising Radiations Jun. 1966 p 13–20 refs (See N66-39101 24-04)

Some biological monitoring procedures which may be used for estimation of the dose following accidental intake of radioactive material are briefly reviewed. It is considered that the initial dose estimate is most important in order to decide whether therapeutic procedures should be started in order to reduce the radionuclide effect in the body. Dose assessment methods are outlined for measuring: the environment, workers' exposure, and excretion of radionuclides. Details are included on irradiation from ingestion and inhalation of insoluble and insoluble radioactive compounds, and wound contamination. R.Li.

N66-39106# Federal Aviation Agency, Oklahoma City, Okla. Office of Aviation Medicine.

HYPOXIA AND PERFORMANCE DECREMENT

William F. O'Connor, Jim Scow, and George Pendergrass May 1966 11 p refs

(AM-66-15)

The concept of "time of useful consciousness" fails to take into account the progressive decay that occurs in performance under hypoxic conditions. This study, using a means of quantitatively assessing such a decrement, presents data obtained in a series of chamber runs at 27,500 and 35,000 feet. The performance-decrement functions appear to follow the arterial-oxygen-saturation curves. Author

N66-39294*# Cedars of Lebanon Hospital, Los Angeles, Calif. Inst. for Medical Research.

A TECHNIQUE FOR TESTING HEART FUNCTION BY ANALYSIS OF ITS VIBRATION SPECTRUM Progress Report

Clarence M. Agress 31 Aug. 1966 62 p refs

(Grant NsG-289)

(NASA-CR-78747) CFSTI: HC $3.00/MF $0.75 CSCL 06E

Human and animal studies were performed to obtain meaningful data describing cardiovascular performance and functioning by application of a vibrocardiogram under conditions when direct physiological measurements were impractical. Animal research centered on correlation of stroke volume measurements with the duration of the ejection and isometric periods, and the study of cardiac contractility under various types of stress. A progressive decrease of isometric intervals was found as the stroke volume enhanced, while the ejection interval increased; thus the resultant ratio closely paralleled the increasing stroke volume. Human studies were performed to assess the use of vibrocardiographic as well as other indirect methods for the evaluation of cardiovascular functions in the acutely ill patient. Special exercise studies were also included to compare stroke volume and cardiac output responses of normal and cardiac injured persons. Resulting data indicated a linear relationship between the ejection-isovolumetric ratio to stroke volume. Data from the exercise studies established a definite difference in stroke volume between healthy and cardiac injured human subjects. G.G.

N66-39342# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ELECTRIC SLEEP AND HYPNOSIS IN DERMATOLOGY (SELECTED PARTS)

M. M. Zheltakov, Yu. K. Skripkin, and B. A. Somov 13 May 1966 75 p refs Transl. into ENGLISH from the Book "Electrosn i Gipnoz v Dermatologii" Moscow, 1963 p 114–166

(FTD-TT-65-1981; TT-66-61957; AD-636672) CFSTI: HC $3.00/MF $0.75

CONTENTS:

1. HISTORICAL SKETCH OF THE DEVELOPMENT OF THE DOCTRINE OF HYPNOSIS p 1–26 refs (See N66-39343 24-04)

2. THE THERAPEUTIC USE OF HYPNOSIS IN DERMATOLOGY p 27–61 refs (See N66-39344 24-04)

N66-39343# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

HISTORICAL SKETCH OF THE DEVELOPMENT OF THE DOCTRINE OF HYPNOSIS *In its* Elec. Sleep and Hypnosis in Dermatol. 13 May 1966 p 1–26 refs (See N66-39342 24-04) CFSTI: HC $3.00/MF $0.75

The development of the doctrine of hypnosis in its physiological and psychiatric aspects is reviewed. Cerebral reflexes conditioned response, therapeutic use, hypnotic sleep suggestions, verbal suggestion versus fixed stare methods, hypnotherapy, inhibitory processes, and other concepts investigated in experiments with humans and animals are outlined. R.Li.

N66-39344# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE THERAPEUTIC USE OF HYPNOSIS IN DERMATOLOGY *In its* Elec. Sleep and Hypnosis in Dermatol. 13 May 1966 p 27–61 refs (See N66-39342 24-04) CFSTI: HC $3.00/MF $0.75

Psychotherapy and hypnotic suggestion methods are reviewed for treating: psoriasis, eczema, alopecia areata, severe pruritus, plantar warts, hypnotherapy in obstretrical anesthesia, lichen ruber planus, urticaria, neurodermatitis, erysipeloid, polymorphic exudative erythema, and other skin diseases. R.Li.

N66-38373*# Sandia Corp., Albuquerque, N. Mex.
DEPOSITION OF NUTRIENTS TO SURFACES OF RODAC PLATES (PART II OF MICROBIOLOGICAL STUDIES RELATING TO CLEAN ENVIRONMENTS)
John William Beakley, W. J. Whitfield, and J. C. Mashburn Sep. 1966 16 p refs
(NASA Order R-09-019-040)
(NASA-CR-78766; SC-RR-66-388) CFSTI: HC $1.00/MF $0.50 CSCL 06M

The deposition of nutrient residues onto surfaces following impressions made with Rodac plates has been observed, photographed, and quantitated. In the experiments performed, a medium residue between 20 and 50 micrograms in weights was deposited from Rodac plates onto stainless steel surfaces. Such residues were shown to be adequate to support microbial growth when such surfaces were contaminated and incubated under ideal conditions of humidity and temperature. Author

N66-39418# Production Group, United Kingdom Atomic Energy Authority, Annon (Scotland).
HEALTH AND SAFETY RESEARCH AT CHAPELCROSS Annual Report, 1965
J. H. Martin

Various activities in the field of radiation health and safety research are reported. The metabolism of thymine was studied as a biological index of radiation exposure. Means of removing radionuclides and toxic substances from the body using strontium, plutonium, and mercury are evaluated. Pond water studies, data on effects of noise, and neutron dosimetry are mentioned. Radiocarbon dating and identification of alpha emitters occurring in marine samples through use of a proportional counter are described. S.P.

N66-39421# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
RADIOACTIVE PHARMACEUTICALS
Gould A. Andrews, Ralph M. Knisely, Henry N. Wagner, Jr., and Elizabeth B. Anderson ed., Apr. 1966 702 p refs Proc. of the Symp. on Radioactive Pharm., Oak Ridge, Tenn., 1-4 Nov. 1965 *Its* AEC. Symp. Ser. No. 6
(CONF-651111) CFSTI: $5.00

The papers presented at this symposium are provided. The fields of biochemistry, pharmacology, radionuclide production, nuclear medicine and the radiopharmaceutical industry are all well represented. Such subjects as radiochemical purity, stability, and quality control were dicussed as well as subjects such as the principles of radio nuclide labeling, methods of radionuclide production, and pharmachologic properties of localization. Most of the papers are preceeded by a brief abstract. H.S.W.

N66-39474# Kansas State Univ., Manhattan. Dept. of Psychology.
STUDY OF VISUAL PERCEPTION IN HUMANS AND ANIMALS. LABORATORY STUDIES OF THE EFFECTS OF STRESS ON VISUAL FUNCTION
John Lott Brown Aug. 1966 33 p refs
(Contract Nonr-3634(04))
(TR-1; AD-637553) CFSTI: HC $2.00/MF $0.50

The study is concerned primarily with three general classes of stress: (1) unusual patterns of motion to which an observer may be subjected; (2) various agents which may be ingested, inhaled, or contacted; and (3) aspects of the visual world itself, such as excessively high light levels. Emotional stresses are of obvious importance, but these are not treated extensively in the report. TAB

N66-39626*# National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY—A CONTINUING BIBLIOGRAPHY WITH INDEXES, AUGUST 1966
Sep. 1966 217 p refs
(NASA-SP-7011(28)) CFSTI: HC $1.00/MF $1.25 CSCL 06S

Annotated references, subject and personal author indexes are presented in this bibliography on aerospace medicine and biology. Emphasis is placed on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated and actual flight in the earth's atmosphere or in interplanetary space. Included are: NASA entries identified by their STAR accession numbers (N66-10000 series); AIAA entries identified by their IAA accession numbers (A66-10000 series); and LC entries identified by a number in the A66-80000 series. G.G.

N66-39563# Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex.
PATHOLOGY OF DIRECT AIR-BLAST INJURY
Thomas L. Chiffelle Apr. 1966 55 p refs
(Contract DA-49-146-XZ-055)
(DASA-1778; AD-637212) CFSTI: HC $3.00/MF $0.50

Blast injury is a complex and very hazardous phenomenon to the biologic target. Together with effects of thermal radiations from modern nuclear weapons, blast injury (direct and indirect) appears to be accountable for the vast bulk of early deaths and casualties in nuclear explosions. This article has attempted to summarize the important clinical, physiologic, and pathologic information concerning the effects of direct air-blast injury on the biologic subject. Certain features have been emphasized in order to assist the clinical medical officer towards proper management of casualties. A brief description of pulmonary sequelae of blast injury is included for completeness. (Author) TAB

N66-39577# Naval Radiological Defense Lab., San Francisco, Calif.
ARTIFICIAL CULTURE OF MARINE SEAWEEDS IN RECIRCULATION AQUARIUM SYSTEM
John A. Strand, III, Joseph T. Cummins, and Burton E. Vaughan 13 Jun. 1966 23 p refs
(USNRDL-TR-1030; AD-637468) CFSTI: HC $1.00/MF $0.50

Ulva as either sporeling or transplant could be cultured for periods of 3 months in closed recirculating aquarium systems. Early development of Ulva lobata sporelings proceeded normally and rapidly under conditions imposed and compared to closely related species, i.e., Ulva pertusa and Ulva lactuca. A modified Haxo-Sweeney enrichment was used, substituting B vitamins and organic phosphate for soil extract. Continuous flow ultra-violet sterilization and microfiltration were provided. pH was maintained automatically at 7.9 plus or minus 0.3, using tris buffer and gaseous CO2. Improved fluorescent illumination for 13-15 hours favored culture of sporelings and summer transplants. Irradiance was confined to the spectrum lying between approximately 380-725 millimicrons and amounted to 3.7 kilolux. From field observations, photoperiod appeared closely correlated to initiation of vegetative growth during early spring. Water temperature seemed to have a greater effect on the rapid maturation of gametes and zoospores Author (TAB)

N66-39691# Georgia Inst. of Tech., Atlanta. School of Chemistry.
NUCLEIC ACID CHEMISTRY: A MODEL SYSTEM FOR RIBONUCLEIC ACID DEPOLYMERIZATION Scientific Final Report, 1 Nov. 1961-30 Jun. 1966
James R. Cox, Jr. 28 Jul. 1966 5 p refs
(Grant AF-AFOSR-858-64)
(AFOSR-66-1642; AD-637564) CFSTI: HC $1.00/MF $0.50

The report summarizes evidence based on the kinetic behavior of ribonucleic acid model systems that a strong stereoelectronic effect operates in nucleophilic attack on phosphorus. The origin of this effect was ascribed to the geometric requirements of pi bond formation pi between phosphorus and oxygen. This theory was investigated by X-ray diffraction studies of the molecular structure of a suitable compound. (Author) TAB

N66-39594# Centre National de la Recherche Scientifique, Paris (France). Dept. of Cellular Neurophysiology.
NEUROPHYSIOLOGY OF THE APLYSIA GANGLION "AN ELEMENTARY BRAIN" Technical (Final) Report, Apr. 1, 1963–Dec. 31, 1965
A. Arvanitaki-Chalazonitis and Nicolas Chalazonitis (Oceanog. Inst., Monaco) Apr. 1966 20 p refs
(Grant AF-EOAR-63-114)
(AFOSR-66-0598; AD-637558) CFSTI: HC $1.00/MF $0.50

Investigations were conducted aiming at the achievement of 5 main purposes: (1) the rhythmic patterns of the bioelectric behavior and the temporal coordination of activity among given identifiable Aplysia neurons; (2)transitions evoked by synaptic activation; storage of the information; (3) the general receptor properties of the neuronal membrane; a model for a sensory coding; (4) the control exerted by the blood factors: pO2, pCO2, pH; (5) the cytological ultrastructure and cytochemical data in their relations to the foregoing themata. The results have been reported in 42 papers which are listed in this document. TAB

N66-39599# Chicago Univ., Ill. Toxicity Lab.
EFFECTS OF X-IRRADIATION ON THE HEXOBARBITAL METABOLIZING ENZYME SYSTEM OF RAT LIVER MICROSOMES Formal Report, Dec. 1, 1965–May 31, 1966
Kei-Ming Yam and K. P. Du Bois Jun. 1966 33 p refs
(Contract AF 41(609)-2977)
(AD-637574) CFSTI: HC $2.00/MF $0.50

A study was conducted on the influence of X-ray on the development of a hepatic microsomal oxidase that catalyzes the oxidative detoxification of hexobarbital. Exposure of 23-day old male rats to 400 r of X-ray completely inhibited the rapid increase in enzyme activity that normally occurs at this age in male rats. After three weeks following radiation exposure, reversal of the inhibition was observed. Exposure of only the heads of male rats also resulted in inhibition of the enzyme development in the liver, and hypophysectomized, unirradiated rats failed to exhibit the normal increase in enzyme activity. These findings resembled the results of previous investigations in this laboratory on other microsomal enzymes and provided further evidence that radiation acts on some process involved in the synthesis of increased enzyme activity in the livers of male rats through an indirect mechanism probably involving hormonal regulation of microsome enzyme synthesis. X-irradiation (400 r) also inhibited the synthesis of the hexobarbital oxidizing enzyme in the liver of partially hepatectomized male rats. A prolonged duration of action of hexobarbital in irradiated young male rats and hepatectomized, adult rats demonstrated the in vivo effects of inhibition of enzyme synthesis on drug metabolism Author (TAB)

N66-39625# Joint Publications Research Service, Washington, D. C.
ELECTROLYTE CONTENT IN BIOLOGICAL FLUIDS IN HYPOXIA AND THE FUNCTION OF THE COCHLEA
G. M. Komarovich, M. S. Pluzhnikov, and R. I. Titova 19 Sep. 1966 10 p refs Transl. into ENGLISH Dokl. Akad. Nauk SSSR (Moscow), v. 165 no. 6, 1966 p 1488–1490
(JPRS-37688; TT-66-34116) CFSTI: $1.00

Since the ear has been ascribed relative stability under hypoxia conditions compared with other sensory organs, a study was conducted on the action of oxygen deficiency in that organ. Electrolytes in the biological fluids of 27 cats were determed by flame photometry. Data are tabulated for the content of potassium and sodium electrolytes in the perilymph, cerebrospinal fluid, and blood serum in the normal state, and under conditions of pronounced hemic hypoxia. Microphone currents of the cochlea of a cat in the normal state and in hemic hypoxia are compared when an auditory signal of 1000 cps is supplied at an intensity of 100 dB. R.Li.

N66-39653# Naval Radiological Defense Lab., San Francisco, Calif.
TEMPERATURE ADAPTATION OF THE GROWTH AND DIVISION PROCESS OF *TETRAHYMENA PYRMIS*. II: RELATIONSHIP BETWEEN CELL GROWTH AND CELL REPLICATION
Peter Schmid 13 Jun. 1966 35 p refs
(USNRDL-TR-1031; AD-637150) CFSTI: HC $2.00/MF $0.50

Replication rates and volume distributions of Tetrahymena pyriformis GL determined with a commercially available electronic cell counter are reported for several temperatures. Tetrahymena pyriformis GL was cultured in proteose peptone yeast extract medium at 28.0, 30.8, 32.5, and 33.9C. During the period of exponential cell replication at all temperatures, the volume distribution was constant, lognormal and the standard deviation from the median volume was temperature independent. This indicates a steady state of balanced growth at 28.0, 30.8, and 32.5 degrees during exponential cell replication. It is demonstrated that the knowledge of volume distribution and generation time is insufficient for calculating rates of cell growth between divisions unless the parameters for the momentary volume distribution can be measured independently. Statistical evaluation of data from the literature confirms previously reported findings which indicate that growth of Tetrahymena over extended periods of the division cycle is approximately exponential and not linear. The previous proposition that control mechanisms for growth of Tetrahymena and Paramecium are different, is thus unnecessary. A new model, which describes the control of cell growth and cell replication is suggested. The model accounts for the lognormal distributions of generation times and volumes as well as the nearly exponential rate of growth between divisions. The mean rate of cell replication which decreases with increasing temperature, shows a negative correlation with the median log volume of the proposed growth model and furthermore indicates that the growth rate is to a large extent independent of cell replication Author (TAB)

N66-39697*# California Univ., Los Angeles. Space Biology Lab.
INTRINSIC ORGANIZATION OF CEREBRAL TISSUE IN ALERTING, ORIENTING AND DISCRIMINATIVE RESPONSES
W. R. Adey [1966] 58 p refs
(Grants NsG-237; NsG-502; NsG-505)
(NASA-CR-78880) CFSTI: HC $3.00/MF $0.75 CSCL 06P

This review considers the gamut of neural organization, ranging from subcellular events in the genesis of intracellular waves, to the patterns in scalp EEG records characterizing a population of human subjects in states of focused attention and visual discrimination. A tricompartmental model of cerebral tissue is described, with neuronal, neuroglial and extracellular divisions. The role of macromolecular systems at the neuronal surface and in the intercellular fluid is considered. Evidence is presented that mucoproteins and mucopolysaccharides may be responsible for net fixed charges at the cell surface, and may thus play a role in ionic fluxes across the membrane. Divalent cations, such as calcium, may modify these macromolecular configurations. Impedance changes in cerebral tissue accompanying alerting, orienting and discriminative responses are described, with emphasis on their regional distribution, and relationship to levels of learning. Author

N66-39700*# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.
THE DEVELOPMENT OF SPECTRO-SIGNATURE INDICATORS OF ROOT DISEASE ON LARGE FOREST AREAS Annual Progress Report
John F. Wear 30 Sep. 1966 43 p refs
(NASA Order R-09-038-002)
(NASA-CR-78871) CFSTI: HC $2.00/MF $0.50 CSCL 02F

Research employing remote sensing techniques in the visible, near infrared, and thermal infrared portions of the electromegnetic spectrum has been attempted with aerial sensors to discriminate differences in the appearance of healthy and *Poria weirii* root

rot infected Douglas-fir trees. A spectrometric analysis of foliage from the tops of 45 sample trees that represent three tree condition classes, three age classes, and three seasons of the year is considered. Special equipment and aerial sampling techniques were designed and developed to implement the collection of the tree top samples. The use of special aerial photography and thermal infrared radiometer readings is also discussed in this report. Author

N66-39701*# California Univ., Los Angeles. School of Medicine.
THE RENAL LYMPHATICS: AN IMPORTANT FLUID TRANSPORT SYSTEM
A. T. K. Cockett, R. T. Kado, A. P. Roberts, and R. S. Moore [1966] 14 p refs Prepared Jointly with Harbor Gen. Hosp.
(Grants NsG-237-62; NIH HE-09834-02)
(NASA-CR-78876) CFSTI: HC $1.00/MF $0.50 CSCL 06E

Results are presented from studies of enzymes and hormonal concentrations in renal lymph fluid, determination of antibiotic concentrations within the renal interstitium, and the measurement of respiratory gases within renal lymph fluid. Renin-Angiotensin levels on an equal volume basis were found in higher concentrations in renal lymph. Antibacterials and their distribution in the renal lymph, blood and urine are listed. Oxygen tension in renal lymph exceeded the corresponding arterial levels. Implicatic s of these levels are discussed. The data obtained are summarized in graphs and charts. H.S.W.

N66-39702*# California Univ., Los Angeles. School of Medicine.
URINARY REFLUX—THE PHYSICIAN'S DILEMMA
A. T. K. Cockett [1963] 14 p refs Prepared Jointly with Harbor Gen. Hosp.
(Grant NsG-237-62)
(NASA-CR-78877) CFSTI: HC $1.00/MF $0.50 CSCL 06E

A review of published literature on urinary reflux—vesicoureteral regurgitation of urine into the renal pelvis and calyces—is presented. Techniques to demonstrate reflux are examined including the importance of intravesical pressure monitoring before and during mictruition, and radiographic techniques. A standardized radiographic method is discussed. The most frequent cause of urinary reflux is the presence of bladder outlet obstruction. A review of several clinical series with reflux showed that bladder neck obstruction accounts for about 75% of cases in the pediatric age group. Patients with reflux are grouped into three classes: (1) patients with high intravesical pressure, (2) patients with reflux at low intravesical pressures but high urinary volumes, and (3) patients with reflux at low intravesical pressures and low volumes. Careful evaluation and prompt treatment is emphasized and it is stated that one should separate mechanical causes from physiological factors affecting bladder function since the neurogenic bladder is handled differently. H.S.W.

N66-39710*# Public Health Service, Phoenix, Ariz. Communicable Disease Center.
[RESEARCH ON MICROBIOLOGICAL STERILIZATION PROBLEMS] Quarterly Report, Jul.-Sep. 1966
M. H. Goodwin, Jr. 12 Oct. 1966 35 p *its* Rept.-15
(NASA Order R-137)
(NASA-CR-78984) CFSTI: HC $2.00/MF $0.50 CSCL 06E

Continuing research studies on *Bacillus subtilis* var. *niger* and other microorganisms are reported. Emphasis was placed on the methyl methacrylate system to determine (1) the effect of polymerization and subsequent storage on survival of spores of *B. subtilis* var. *niger*, and (2) the spores' die-away rates. In experiments using ultrasonic energy for recovering microbial contaminants, primary consideration was given to testing surfaces with natural contamination resulting from human handling or aerial fallout and also aerosolized spores of *B. subtilis* var. *niger*. Air samples were taken in two operating room with slit samplers and high levels of airborne viable particles (171/cu ft) were found. In developing a technique for injuring bacterial spores with dry heat, typical destruction curves were obtained. Continued research is outlined on assessing microbial contamination levels on lunar spacecraft and assembly environments. N.E.N.

N66-39744# Martin Co., Baltimore, Md. RIAS Div.
AN INVESTIGATION OF THE CHEMICAL MECHANISM OF THE LIGHT REACTION OF PHOTOSYNTHESIS Final Report, Dec. 1, 1964-Jul 31, 1966
Martin Schwartz Aug. 1966 15 p refs
(Contract Nonr-4753(00))
(NR-108-609; AD-637243) CFSTI: HC $1.00/MF $0.50

The report deals with research concerning the mechanism of energy transformation and electron transport in photosynthesis. The research program encompassed a study of the mechanisms of photon absorption and distribution and of electron transport with concomitant phosphorylation Author (TAB)

N66-39751 Naval Radiological Defense Lab., San Francisco, Calif.
EVIDENCE FOR PLURIPOTENTIALITY OF MARROW STEM CELLS: MODIFICATION OF TISSUE DISTRIBUTION OF IN VIVO I^{125}UdR LABELED TRANSPLANTED MARROW
Bernard J. Bryant and Leonard J. Cole 9 Jun. 1966 32 p refs
(USNRDL-TR-1028; AD-637782) CFSTI: HC $2.00/MF $0.50

Mice were exposed to a lethal dose of X-radiation (900 rad) and transfused with 5,000,000 syngeneic bone marrow cells. Subgroups of these mice were either made polycythemic, anemic or served as controls. Regenerative activity in the hemopoietic and lymphopoietic tissues was assessed by flash-labeling with I125-iododeoxyuridine. The evidence based on the incorporation of I125-labeled iododeoxyuridine into DNA, organ weights, histological and H3-thymidine radiautographic data suggests that stem cells in the bone marrow of adult mice may contain both hemopoietic and lympho-/plasmacytopoietic potentialities. The methodology and some possible objections to the interpretation of the data are discussed, and future work is indicated Author (TAB)

N66-39779# Naval School of Aviation Medicine, Pensacola, Fla.
EFFECTS OF SIMULATED HIGH ALTITUDE ON LEFT CIRCUMFLEX CORONARY FLOW, BLOOD PRESSURE, CARDIAC OUTPUT, AND MYOCRADIAL METABOLISM IN THE UNMEDICATED GREYHOUND DOG
Le Roy S. Wirthlin and E. Peter Beck 18 May 1966 28 p refs
(NAMI-985; AD-637583) CFSTI: HC $2.00/MF $0.50

The effects of simulated high altitudes on phasic coronary artery flow, central aortic pressure and flow, and myocardial metabolism were studied in unmedicated greyhound dogs 1-2 weeks after implantation of sensing devices. The adaptation of coronary flow to hypoxia was medicated through an increase in heart rate, coronary vasodilation, and increase in mean pressure. Coronary sinus pO2 was found to correlate highly with arterial pO2. The linear relationship of coronary flow to oxygen usage persisted during hypoxia. Mayer waves with rhythmic fluctuations in coronary flow were encountered Author (TAB)

N66-39794# Naval Air Development Center, Johnsville, Pa. Aerospace Medical Research Dept.
METHODS USED IN A CONTINUING STUDY OF TEMPERATURE REGULATION Phase Report
F. H. Jacobson, Russell D. Squires, R. J. Zahelicky, and W. K. Border 31 Dec. 1965 30 p refs
(NADC-MR-6514; AD-638872) CFSTI: HC $2.00/MF $0.50

Techniques for ablating, as well as for chemical and thermal stimulation and inhibition of the preoptic region of the cat forebrain are described. Methods of measuring various parameters of temperature regulation are also described, and the errors of the measurements assessed Author (TAB)

N66-39796# School of Aerospace Medicine, Brooks AFB, Tex.
POSTIRRADIATION CREATINURIA IN *MACACA MULATTA* PRIMATES
I. G. Peters and H. E. Hamilton Aug. 1966 12 p refs
(SAM-TR-66-21; AD-638622) CFSTI: HC $1.00/MF $0.50

Macaca mulatta primates irradiated by Co^{60} gamma rays in three groups of four animals each to dose levels of 2000, 4000, and 6000 rads showed marked creatinuria. Refinement of the fluorometric determination of creatine based on the reaction of ninhydrine with creatine in alkaline media has been achieved. Interfering guanido compounds calculated on a creatine equivalence constituted from unmeasurable amounts to approximately 10% of the total creatine in samples containing a small amount of creatine. Author (TAB)

N66-39797# Marion (Jerry B.), Silver Spring, Md.
FACILITIES FOR HIGH-INTENSITY NEUTRON IRRADIATION
Jerry B. Marion Bethesda, Md., Armed Forces Radiobiol. Res. Inst., Jan. 1966 62 p
(Contract DA-49-146-XZ-230)
(AFRRI-CR66-4; AD-637458) CFSTI: HC $3.00/MF $0.75

An analysis is made of the possibilities of producing high-intensity beams of neutrons with energies other than 14 MeV. It appears that the 3-MV accelerators which are likely to be available within the next few years will be capable of delivering beams of charged particles with currents up to about 15 mA. With this beam limitation it will not be possible to deliver a sample irradiation flux of more than 10 to the 11th power neutrons/sec, if monoenergetic neutrons are required. On the other hand, present capabilities of higher energy accelerators (e.g., 100-MeV cyclotrons) will permit the generation of approximately 10 to the 15th neutrons/sec. Since the majority of these neutrons are emitted into a very narrow forward cone, it would be possible to utilize almost the entire neutron output for irradiation purposes. For biological studies in which the maximum possible neutron flux is required, it appears that an accelerator which will yield beam energies considerably in excess of 3 MeV will be required. TAB

N66-39798# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.
ELECTROPHORETIC SEPARATIONS ON ACRYLAMIDE GELS: DISC ELECTROPHORESIS Final Report
Leandro Rendon Dec. 1965 36 p refs
(AMRL-TR-65-202; AD-637228) CFSTI: HC $2.00/MF $0.50

Disc electrophoresis, a new method for fractionating serum proteins and enzymes developed by Ornstein and Davis (Ann. N. Y. Acad. Sci. V121 P321 1964), possesses great sensitivity, speed and reproducibility while requiring a sample as little as 3 microliters in routine separations. The technique as adapted and standardized for use in the Toxic Hazards Branch, Aerospace Medical Research Laboratories, for serum protein and Lactic Dehydrogenase (LDH) isozyme separations is presented along with suggestions for making the apparatus needed to perform disc electrophoresis. Author (TAB)

N66-39801# Honeywell, Inc., St. Paul, Minn. Systems and Research Div.
INTRASPECIES BIOLOGIC AND BEHAVIORAL VARIABILITY
Stirling P. Stackhouse Brooks AFB, Tex., School of Aerospace Med., Jun. 1966 30 p refs
(Contract AF 41(609)-2937)
(SAM-TR-66-58; AD-637946) CFSTI: HC $2.00/MF $0.50

Parameters are selected which will be useful in studying intraspecies biologic and behavioral variability for man and rhesus monkeys. The variability data can be used to form subgroups of men and monkeys useful in subsequent radiation experiments. The criteria used in selecting the parameters for measurement were high variability, man-monkey variability correlation, physiologic significance, and radiation sensitivity. (Author) TAB

N66-39823# Production Group, United Kingdom Atomic Energy Authority, Annon (Scotland).
THE BIOLOGY OF THE SOLWAY FIRTH IN RELATION TO THE MOVEMENT AND ACCUMULATION OF RADIOACTIVE MATERIALS. PART II: THE DISTRIBUTION OF SEDIMENTS AND BENTHOS
E. J. Perkins and B. R. H. Williams 1966 65 p refs
(PG-587(CC)) HMSO: 10s

Data for the distribution of sediments and benthos in relation to insoluble or particulate radioactive nuclides is presented. The mechanisms of transport of silt and associated radioactivity in the N.E. Irish Sea and the Solway Firth are shown to be primarily due to the differential between flood and ebb tide velocities consequent upon distortion of the tidal wave. A possible reason for the fundamental difference between marshes bordering upon the Irish Sea and those of the east coast of England is discussed. Author

N66-39840# Institute for Perception RVO-TNO, Soesterberg (Netherlands).
SOME CONSIDERATIONS ON EYE HAZARDS WITH LASERS
J. J. Vos 1966 26 p refs
(TDCK-46027; IZF-1966-4) CFSTI: HC $2.00/MF $0.50

Eye hazards by laser radiation are described and discussed on the basis of experimental data on animals, theoretical consideration on heat dissipation, and recent data on ocular imagery. Critical doses are determined and thicknesses calculated for protective filters. Tentative safety prescriptions, on this basis, conclude the report. Author

N66-39855# Chicago Medical School, Ill. Dept. of Biochemistry.
ABSORPTION SPECTRA OF PEPTIDES AND PROTEINS IN THE ULTRAVIOLET Final Report, 1 May 1955–31 Dec. 1964
Leo J. Saidel 15 Jul. 1966 13 p refs
(Contract Nonr-1655(01))
(AD-637180) CFSTI: HC $1.00/MF $0.50

By various methods residue spectra were estimated for all of the amino acid residues commonly occurring in proteins and tentative comparisons of summed residue spectra with measured protein spectra were made for glucagon, insulin, ribonuclease, muramidase and bovine serum albumin at 205 millimicrons and 230 millimicrons. All of the calculated molar extinction coefficients at 205 millimicrons are within the range of 1.04 to 0.89 of the observed values whereas the corresponding rations at 230 millimicrons are within the range of 0.98 to 0.66. At neither wavelength do the differences correlate well with the helical content of the proteins determined by rotatory dispersion Author (TAB)

N66-39798# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.
HEMODYNAMIC AND METABOLIC RESPONSES OF INFUSHED LOW MOLECULAR WEIGHT DEXTRAN Technical Report, Nov. 1965–Apr. 1966
Eugene Evonuk Jun. 1966 17 p refs
(AAL-TR-66-9; AD-637473) CFSTI: HC $1.00/MF $0.50

Thirteen series of experiments were conducted to determine some hemodynamic and metabolic responses of infused LMD (low molecular weight dextran, 40,000) in rats. Oxygen consumption, respiratory quotient, circulating histamine levels, arterial and venous pressure, cardiac output and volumes percent of blood PO_2 and PCO_2 were determined before and at various intervals after LMD infusion. The infusion of LMD resulted in a significant decrease in oxygen consumption, increase in respirstory quotient, increase in circulating histamine, decrease in arterial and vanous pressures, a decrease in cardiac output, and decrease in venous PO_2 and arterial PCO_2. From these responses of infused LMD it se concluded that the metabolic processes are uninhibited at the peripheral cellular

level and that the reduction in metabolic rate was due to a marked peripheral hemostasis and failure of the circulatory system to supply the oxygen demand. Author (TAB)

N66-39866# Strasbourg Univ. (France).
EXPERIMENTAL STUDY OF THE TREATMENT OF RADIATION INJURIES BY PADUTIN (KALLIKREINE) Annual Activity Report, 10 Jan. 1964–4 Jan. 1965 [ETUDE EXPERIMENTALE DU TRAITEMENT DES RADIOLESIONS PAR LA PADUTINE-DEPOT (KALLICREINE)
P. Mandel, J. M. Mantz, M. Deleman, C. Gary, P. Michaelidis et al Brussels, EURATOM, Jul. 1966 25 p In FRENCH, ENGLISH summary
(Contract Euratom-054-63-10 BIOF)
(EUR-2477.f, Vol. II) CSFTI: HC $1.00/MF $0.50

Experimental results confirmed the favorable effect of padutin (kallikrein) in the treatment of experimental radionecrosis in rats and guinea pigs. Tests on the rat showed that padutin has an optimum effect, the optimum dose in the rat appears to be 5 BU. The possible restorative and protective effect of padutin after total body irradiation (800 r) compared with other therapeutic substances is discussed. Present results suggest that padutin exercises a favorable influence as a restorative on the survival of irradiated animals. However, quantitative determinations of bone-marrow nucleic acids and cytological investigations, conducted concurrently, have also shown that padutin has a restortive action, which is particularly noticeable on the seventh day after irradiation. As regards RNA, this action would appear to be more pronounced in that of padutin than in that of AET. Where DNA is concerned, protection is of the same order of magnitude for both the substances used. Experiments on the effect of padutin on cicatrization in the pig have been concerned mainly with the anesthesia process and determination of the optimum irradiation dose which produces stable X-ray dermatitis. L.W.

N66-39884# Central Lab. for Radiological Protection, Warsaw (Poland).
NATURAL AND ARTIFICIAL (FROM NUCLEAR EXPLOSIONS) GAMMA BACKGROUND RADIATION IN POLAND: DOSES RECEIVED BY THE POPULATION
J. Pensko 1966 40 p refs
(CLOR-49/D) CFSTI: HC $2.00/MF $0.50

The results of the environmental dose rate measurements of more important gamma emitters, natural and fission products for 20 different places in Poland are presented and discussed. Mainly the spectrometric method has been used and some measurements were done by means of the high pressure ionization chamber. The fission products from nuclear explosions considerably changed the natural gamma-ray background in Poland especially in summer 1963. The photopeak of Mn-54, which corresponds to the energy of 0.840 MeV, was observed in the spectrograms obtained in 1964. Author

N66-39889*# TRW Systems, Redondo Beach, Calif.
APPLICATION OF IMMOBILIZED BIOLOGICAL AGENTS TO WASTE TREATMENT Final Report, 25 May 1965–26 Jul. 1966
[1966] 79 p refs
(Contract NAS2-2857)
(NASA-CR-73033; TRW-05027-6001-R000) CFSTI: HC $2.50/MF $0.75 CSCL 06K

This report describes the work performed during this contract period to determine the applicability of systems utilizing aerobic immobilized biological agents under aerobic conditions for the treatment of human waste in space capsules. Several fixed bacterial beds were designed and constructed for conducting experimental studies in the laboratory. Two large packed columns containing a microbial layer grown on the surfaces of a polypropylene growth support were operated continuously, first individually and then in series. After appropriate conditioning on domestic sewage, the columns were converted to a form capable of acting upon human waste-water mixtures. Operated in series, the columns reduced the chemical oxygen demand of feces by 80 to 85 percent in a single pass. Thus, this study has resulted in the successful operation of a microbiological fixed-bed system utilizing electrochemically generated oxygen. Author

N66-39918*# Massachusetts Inst. of Tech., Cambridge.
DISCHARGE PATTERNS OF SINGLE FIBERS IN THE CAT'S AUDITORY NERVE
Nelson Yuan-Sheng Kiang, Takeshi, Eleanor C. Thomas, and Louis F. Clark 1965 154 p refs *Its* Res. Monograph No. 35
(Grant NsG-496; NIH NB-01344; NSF GP-2495; NIH G-MH-0473-05; Contract DA-36-039-AMC-03200(E)
(NASA-CR-79115) CFSTI: HC $5.00/MF $1.00 CSCL 06C

Presented is a monograph which represents a systematic attempt to quantitatively describe the electrophysiological responses in the peripheral auditory nervous system. The purpose of this research was to discover how the mammalian auditory nerve describes sounds by examining the patterns of discharges in single fibers of the auditory nerve in response to controlled acoustic stimuli. The research was conducted on healthy adult cats, however it is surmised that results should have important bearing on the study of human hearing. Data are presented on methods and surgical procedures, spatial organization of the auditory nerve, response patterns to standard clicks, response patterns in relation to changes in click level, polarity, duration, and rate; response patterns to noise and tonal stimuli, tuning curves, spontaneous activity, and responses to combinations of simple acoustic stimuli. Results are presented within a framework that indicates the purpose and significance of each series of experiments. S.C.W.

N66-39919# Minnesota Univ., Minneapolis. School of Public Health.
THE BACTERIOLOGY OF "CLEAN ROOMS" Final Report
O. R. Ruschmeyer and D. Vesley Jul. 1966 89 p refs
(Grant NSG-643)
(NASA-CR-79114) CFSTI: HC $3.00/MF $0.75 CSCL 06M

Research focusing on the development of comprehensive standards for the sterilization of space hardware to assure that no man-made object impacting on a potential biological preserve in space will introduce biota of earthly origin, is reported. Presented are results of comparative studies of microbial levels in the environments of four industrial clean rooms which were made to determine the difference in contamination levels related to the specific controls in each room; an evaluation of specific factors thought to be important in minimizing the level of contaminants on space hardware; and preliminary comperative data on microbial contamination levels in a laminar flow room and conventional clean rooms. Some of the significant conclusions are summarized as follows: (1) Microbial evaluations of conventional clean rooms revealed contamination levels about one order of magnitude below minimum levels in critical areas of hospitals; (2) Predictably, the contaminants were approximately 75% species associated with shedding from human sources and no more than 10% appeared to be spore forming varieties; and (3) The laminar down flow room can achieve a further reduction in contamination levels of several orders of magnitude below the best conventional clean rooms. S.C.W.

N66-39925# Federal Aviation Agency, Oklahoma City, Okla. Office of Aviation Medicine.
PROBLEMS IN AVIATION PERSONNEL: INFLUENCE OF A TRANQUILIZER ON TEMPERATURE REGULATION IN MAN
P. F. Iampietro, V. Fiorica, J. R. Dille, E. A. Higgins, G. Funkhouser et al May 1966 10 p refs
(AM-66-14)

The effects of a tranquillizing drug of the propaediol group, meprobamate, on thermal balance of men exposed to a cold (50°F, 10°C), hot (110°F, 43.3C), or neutral (80°F, 26.7°C) environment have been investigated. Results show that a single dose of meprobamate (800 mg) has no effect on temperature regulation of men resting in a neutral environment. During exposure to hot or cold environments, however, the drug groups showed impairment in thermal balance. In the cold, heat production and core temperature of the drug group were lower than the placebo group. In the heat, only moderate elevations in the core temperatures of the drug group were detected. Possible physiological mechanisms responsible for these differences are discussed.
Author

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N66-38821*# Melpar, Inc., Falls Church, Va.
APOLLO PULMONARY GAS COLLECTION ASSEMBLY AND ASSOCIATED EQUIPMENT DEVELOPMENT PROGRAM Final Report
[1966] 84 p refs
(Contract NAS9-5514)
(NASA-CR-65537) CFSTI: HC $2.50/MF $0.75 CSCL 06K

Details are given on the development, fabrication, and flight qualification of a pulmonary gas collection assembly designed for collecting expired respiratory gas from flight crew members during rest, exercise, and maximum voluntary ventilation. Performance and design requirements are specified for the equipment which consisted of the pulmonary gas collection assembly, nose clip, mouthpiece, breathing valve, and interconnecting tubing. Both the storage and operational configurations are considered. A detailed description of the design approval testing and test data is included, and test procedures and results for the items subjected to the qualification tests are summarized. Flow diagrams and schematics are also included.
M.G.J.

N66-38922*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
DEVELOPMENT OF PROTOTYPE MASS MEASUREMENT SYSTEM FOR SPACEFLIGHT
R. B. Maine and A. L. Weitzmann Langley Station, Va., Langley Research Center, 28 Oct.1966 93 p refs
(Contract NAS1-5999)
(NASA-CR-66174) CFSTI: HC $2.50/MF $0.75 CSCL 06B

Described is the construction and evaluation of a prototype equipment specifically designed to monitor mass changes of astronauts, and to determine the mass of spacecraft materials during orbital flight. Conceptual designs and laborstory experimental work were reviewed and a comparison analysis was conducted for optimum technique selection. Of the many systems studied, the oscillating spring-mass system was selected for hardware developments; testing of MMS hardware proved that accuracies of less than ±0.25 pounds were possible in the weight range of 5 to 40 pounds and a ±0.50 pound accuracy was achieved in the 41 to 250 pound range. The accuracy for human subjects was within ±1 pound. Investigations proved that a basic MMS with minor changes can be used to determine human threshold accelerations in the range of 5 to 10 cm/sec^2.
G.G.

N66-38976# Naval Training Device Center, Port Washington, N. Y.
PHYSIOLOGICAL CORRELATES OF LEARNING AND OVERLEARNING
John L. Andreassi and Patricia M. Whalen Jun. 1966 30 p refs
(NAVTRADEVCEN-IH-56; AD-636397) CFSTI: HC $2.00/MF $0.50

Two experiments were conducted to investigate physiological activity associated with original learning and overlearning of verbal materials (nonsense syllables). In experiment I, the physiological responses measured were heart rate (HR), palmar skin conductance (PSC), and galvanic skin response (GSR) during original learning, overlearning and new learning. In experiment II, the same physiological responses were recorded but original learning was followed by two overlearning phases. The results showed that: (1) There were decreases in all of the physiological measures with overlearning, i.e., further practice with mastered materials; (2) there were increases in all of the measures with new learning; and (3) further decreases in physiological activity occurred with "double overlearning" (practice with mastered materials after the overlearning phase). It was concluded that the drop in physiological activity which occurred with overlearning was due to an habituation of the physiological responses with decreased novelty in the learning materials and a reduction in apprehensiveness as the experiment progressed.
Author (TAB)

N66-38997# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ORIENTATION OF MAN IN SPACE
A. A. Leonov and V. I. Lebedev *In its* Cosmic Res., vol. III, No. 6 [1966] p 220–232 refs (See N66-38986 24-30) CFSTI: HC $6.00/MF $1.25

The psychophysiological mechanisms by which man orients himself under conditions of terrestrial gravity, in flight on jet aircraft simulating weightlessness, under the conditions of orbital flight and on emerging from the spacecraft into outer space are analyzed. It is reported that no disorientation was observed when a cosmonaut stepped out of his spacecraft into space. The conclusion drawn is that even more thorough medical screening and more comprehensive preparation of the cosmonauts will be necessary for the longer "walks in space" to come.
Author

N66-39107# Federal Aviation Agency, Oklahoma City, Okla. Office of Aviation Medicine.
SELECTED FACIAL MEASUREMENTS OF CHILDREN FOR OXYGEN-MASK DESIGN
Joseph W. Young Apr. 1966 19 p
(AM-66-9)

Requirements for design of oxygen masks and other equipment for effective protection of children in high-altitude flight necessitate a new facial-measurement series. A program to meet this demand was initiated to (1) select a basic set of standard measurements, (2) define and standardize new measurements of specific structural features based on well-defined or established anatomical landmarks, (3) conduct a series of surveys on selected representative children of all ages, and (4) determine significant dimensional ranges of facial structures for use as standardized design criteria. The new series provides 10 standard and 8 new facial measurements, all of which are dimensionally related to other common measuring points to permit a comparison with other series of facial measurements. This survey is based upon a selected population of 978 Caucasian subjects of ages 1 month through 17 years. The number of subjects in each age and sex group was controlled to assure constant sample distribution throughout the series. A continuation of this study is proposed to include representative populations for both the Negro and Mongoloid types.
Author

N66-39301# Naval Research Lab., Washington, D. C.
AN INTERESTING CASE OF CLOSED ATMOSPHERE CONTAMINATION
R. A. Saunders *In its* Rept. of NRL Progr. Aug. 1966 p 1–4 ref (See N66-39300 24-34)

Evaluated was a completely integrated life support system in an experiment which involved maintaining five men for thirty days in a hermetically sealed environmental chamber. The members of the crew lost their appetites, became nauseated, suffered severe vomiting, and developed headaches and odd facial sensations. These symptoms together with other difficulties prompted test termination after four days. Preliminary efforts to pinpoint medically the cause of the sickness were unsuccessful. Later analysis of the chamber atmosphere identified 23 volatile compounds. Among these were mono- and dichloroacetylene. The latter compound is known to produce symptoms identical to those experienced by the chamber crew. Dichloroacetylene has since been found at low concentration in a submarine atmosphere also. A certain few of the chlorinated hydrocarbons customarily have been tolerated in most closed environmental atmospheres because of their general usefulness and relatively low toxicity. Such was the case in both of these instances. The toxicant was produced through the action of an improperly operating element of the environmental control system on one of these compounds. Author

N66-39395*# IIT Research Inst., Chicago, Ill. Astro Sciences Center.
SURVEY OF BIOCLEAN FACILITIES. VOLUME I: GUIDELINES FOR EVALUATION, CONDUCT OF SURVEY, AND COST ESTIMATION FOR MODIFICATIONS
D. L. Roberts and J. Stockham Dec. 1965 51 p refs
(Contract NASr-65(06))
(NASA-CR-78753) CFSTI: HC $3.00/MF $0.50 CSCL 06T

Survey and evaluation of a number of fabrication facilities with operational, contamination controlled areas were performed to determine their suitability for the production of microbiological sterile spacecraft. A total of ten facilities visited were found to be suitable for modification to bioclean assembly areas for the 20' spacecraft, and an additional six were judged suitable for bioclean assembly of the 12' spacecraft. Laminar downflow high-bay clean rooms were not available and have to be installed. G.G.

N66-39413# Joint Publications Research Service, Washington, D. C.
MAN AND AUTOMATIC MACHINES
V. Pelipeyko 29 Sep. 1966 14 p Transl. into ENGLISH from Nauka i Tekhn. (Riga), no. 7, Jul. 1966 p 10-12
(JPRS-37897; TT-66-34325) CFSTI: $1.00

The role of cybernetic equipment in relation to the functions of man during interplanetary space travel is evaluated. Consideration is given to the capabilities and shortcomings of both methods of spacecraft control, and low reliability is stressed as the main shortcoming of complete automatic control. The problems of a soft landing on the moon, take-off, and return to earth are mentioned. It is concluded that both the psychophysiological characteristics of the cosmonaut and the technical capabilities of the automatic apparatus are necessary for different functions and individual stages of space research. S.P.

N66-39456# Washington Univ., Seattle. Psychophysics Lab.
SOME INVARIANCES OF THE ISO-SENSITIVITY FUNCTION AND THEIR IMPLICATIONS FOR THE UTILITY FUNCTION OF MONEY
Eugene Galanter and Garvin L. Holman 1 Dec. 1965 21 p refs
(Contracts NONR-477-34 ; DA-49-193-MD-2713)
(PLR-18NA, AD-637554) CFSTI: HC $1.00/MF $0.50

Four experiments were performed in which human observers reported whether or not they could detect the difference in amplitude between a pair of acoustic stimuli presented on each of several thousands of trials. In one experiment the probability that the pair differed was systematically varied. In another experiment the relative monetary value to the observer of reporting the differences was systematically varied. In a third experiment the instructions to the subject were systematically varied, and in a fourth experiment the monetary value of reporting a difference was altered by multiplying the rewards by a positive constant. In the first three experiments the iso-sensitivity function, the function that describes the relation between correct reports of a difference and false reports of a difference, was unchanged under all conditions. In the fourth experiment the absolute response probabilities of correct detections and false reports were reproduced even though five-fold changes in monetary value were made. This last result lends additional empirical support to the accumulating evidence that the utility function of money is a power function Author (TAB)

N66-39467# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SENDING THE PULSE BY RADIO
V. Trisvyatskaya 23 Feb. 1966 5 p Transl. into ENGLISH from Kommunist (Moscow), 4 Aug. 1965 p 4
(FTD-TT-65-1710; TT-66-62124; AD-637514) CFSTI: HC $1.00/MF $0.50

The biocurrents of the heart and the pulse in the finger tips are simultaneously transmitted by radio and recorded by radio-sphygmotachocardiograph. Liquid electrode-sucking-disks are used to pick up the biocurrents of the heart. Semiconductor photo-resistors placed on the finger tips are used to record the filling of the fingers by blood. A miniature lamp illuminates the fingers from the opposite side. The translucence of the fingers changes as the vessels are filled with blood, thus changing the illumination on the photoresistors and their electrical characteristics. Frequency modulation and two separate amplifiers are used to ensure that the instrument operates stably. The transmitter is fed from a battery of seven cells, each of which is no bigger than a hazel nut. The instrument of the investigator consists of a receiver (similar to an automobile receiver), a decoder and an automatic writing device. The time of propagation of a pulse wave is calculated with an accuracy up to 1/100 of a second. TAB

N66-39480# St. Louis Univ., Mo. School of Medicine.
PHOTOELECTRIC PLETHYSMOGRAPHY USING FIBER OPTICS FOR APPLICATION IN THERMAL PHYSIOLOGY Technical Report, May 1963-Sep. 1964
Alrick B. Hertzman and Franz Flath Wright-Patterson AFB, Ohio, AMRL, Apr. 1966 14 p refs
(Contract AF 33(657)-11551; Grants PHS H-4839; PHS HE-07070)
(AMRL-TR-66-31; AD-637173) CFSTI: HC $1.00/MF $0.50

Several designs of photoelectric plethysmographs utilizing fiber optics are described. One arrangement is used for studies on the cutaneous circulation. A modification of this design was applied successfully to the oral mucosa in climate chamber experiments. With a light wire substituted for the photocell, interference filters and multiplier phototubes may be combined for spectrophotometric recording. This arrangement is particularly useful for following changes in blood content of the illuminated tissue during changes in ambient temperature. Author (TAB)

N66-39481# Kentucky Univ., Lexington. Dept. of Physiology and Biophysics.
A PELTIER EFFECT HEAT EXCHANGER APPROPRIATE FOR TEMPERATURE REGULATORY STUDIES IN SMALL ANIMALS Progress Report, 1 Nov. 1964-31 Oct. 1965
Robert E. Smith and John Krog Ft. Wainwright, Alaska, Arctic Aeromed. Lab., Jun. 1966 13 p refs
(Contract AF 41(609)-2684)
(AAL-TR-66-6; AD-637493) CFSTI: HC $1.00/MF $0.50

A miniature heat exchanger for extracorporeal circulation systems is described. It utilizes Peltier effect semiconductors as heat pumping devices. In contrast to the traditional use of circulating water as heat source or sink. This unit has proven capable of providing rapid heating and cooling of circulating

blood with minimal thermal lag. It is capable of precise control, immediate reversal of direction of heat flow and is readily adapted to automatic control. It introduces a minimum of dead space into the extracorporeal circulatory system and is readily cleaned. Author (TAB)

N66-39574# Lehigh Univ., Bethlehem, Pa. Center for the Information Sciences.

THE APPLICATION OF PSYCHOMETRIC TECHNIQUES TO DETERMINE THE ATTITUDES OF INDIVIDUALS TOWARD INFORMATION SEEKING AND THE EFFECT OF THE INDIVIDUAL'S ORGANIZATIONAL STATUS ON THESE ATTITUDES

Victor Rosenberg (M.S. Thesis) Jul. 1966 53 p refs
(Grants AF-AFOSR-724-66; NSF GE-2569)
(Rept.-2; AD-637713) CFSTI: HC $3.00/MF $0.50

A structured questionnaire was administered to professional personnel in industrial and government organizations, asking the subjects to rank eight information gathering methods according to their preference in given hypothetical situations. The subjects were then asked to rate the methods on a seven point scale according to (a) ease of use and (b) amount of information expected. A statistical analysis of the data from 94 subjects (52 in research, 44 in nonresearch) showed that no statistically significant differences were present in either the rankings or ratings between research and nonresearch personnel. A high significant correlation was found, however, between the preference ranking and the ease of use rating within both groups, whereas no significant correlation was found between the preference ranking and the amount of information ratings. The results of the study infer that the ease of use of an information gathering method is more important than the amount of information expected for information gathering methods in industrial and governmental environments, regardless of the research orientation of the users. (Author) TAB

N66-39632# Dunlap and Associates, Inc., Santa Monica, Calif. Wester Div.

A RATIONALE FOR EVALUATING VISUAL LANDING AIDS: NIGHT CARRIER RECOVERY Final Report, 1 Mar. 1963–1 Mar. 1964

Richard P. Winterberg, Clyde A. Brictson, and Joseph W. Wulfeck Mar. 1966 141 p refs
(Contract Nonr-4118(00))
(AD-637508) CFSTI: HC $4.00/MF $1.00

A primary conclusion of the study is that no objective measure of the quality of an approach and landing other than the untimely and inadequate one of accident rate exists for use as a criterion in evaluating visual landing aids. In the absence of such a criterion an analysis of the night carrier aircraft recovery operating procedure and environment was conducted to determine the visual characteristics of the carrier/pilot/aircraft subsystem interaction. The hypothesis emerged that the visual information available to the night carrier pilot is more similar to that available from an instrument display than it is to the information provided by daylight contact flight. The hypothesis was tentatively supported by an analysis of pilot opinion data. Therefore, sets of criteria applicable to visual landing aid evaluation were developed from those which have been established for visual displays in general. Those criteria, while useful, are qualitative and to a certain extent speculative Author (TAB)

N66-39655# Cambridge Univ. (England). Psychological Lab.

VISUAL PERCEPTION OF MOVEMENT Interim Scientific Report No. 1, 1 Apr. 1965–31 Mar. 1966

R. L. Gregory and J. A. M. Howe 21 Jun. 1966 77 p refs
(Grant AF-EOAR-65-62)
(AFOSR-66-1532; AD-637510) CFSTI: HC $3.00/MF $0.75

The research includes: (a) investigation of the use of pitch of a sound as a distance cue; (b) investigation of the maintenance of retinal fusion as an object moves in depth; (c) description of the apparatus developed for moving observers at constant velocity; (d) investigation of apparent depth and perspective set up by a line at different inclinations from the vertical; and (e) measurements of the magnitude of the Ponzo illusion for different positions of the horizontal lines within the oblique lines. Author (TAB)

N66-39658# Honeywell, Inc., St. Paul, Minn. Systems and Research Div.

A STUDY OF VISUAL SEARCH USING EYE MOVEMENT RECORDINGS Semiannual Progress Report, 1 Jan.–30 Jun. 1966

L. G. Williams 30 Jun. 1966 8 p ref
(Contract Nonr-4774(00))
(Rept.-12009-IR2; AD-637281) CFSTI: HC $1.00/MF $0.50

The report is a summary description of the progress during the first six months of the second year of the visual search program. The first study of 1966 is an investigation of the use of size information for acquiring targets. This is nearing completion. The second study is an investigation of the use of color information. It is in an advanced stage of preparation. The objective in both experiments is to develop a framework for predicting the precise proportions of fixations on objects in different size and color categories as a function of the target specification and field composition Author (TAB)

N66-39671# Minneapolis-Honeywell Regulator Co., Minn. Military Products Group.

RESEARCH ON COMPLEX PERCEPTUAL MOTOR SKILLS Final Report

Carl A. Silver 20 Jul. 1960 34 p refs
(Contract Nonr-3011(00))
(RR-1520-TR1; AD-637260) CFSTI: HC $2.00/MF $0.50

An apparatus was constructed which produces any selected correlation in the range −1.0 to +1.0 by mixing three random time functions. Three experiments, each using the same ten subjects, were completed using this apparatus. Thresholds for the perception of positive and negative correlations were obtained using both a two-choice and a three-choice design. A normal ogive is a satisfactory fit to the data. Author (TAB)

N66-39680# Stanford Univ., Calif. Graduate School of Business.

PERCEPTION OF LEADERSHIP IN SMALL GROUPS: PERSONALITY DIFFERENCES IN DISCUSSION GROUP BEHAVIOR

Thomas W. Harrell Aug. 1966 39 p refs
(Contract Nonr-225(62))
(TR-11; AD-637254) CFSTI: HC $2.00/MF $0.50

The problem was to determine whether there were personality differences between choices following small group discussions. Such personality differences, if they existed, could predict the emergence of leadership behavior in initially leaderless groups. There were 26 personality differences significant at the .05 level or higher between the extremes in MBA five or four man discussion groups on either number of times talked, or sociometric choices of leadership, or guidance, or best ideas, or being liked. There were 14 personality differences significant at the .05 level or higher in the combination of MBA and Executive Development Program five man groups on either guidance, best ideas, or being liked. Ascendance and General Activity were higher for the number 1 men in Guidance in each of the three sets of groups, MBA five man groups, MBA four man groups, and combined Executive Development Program and MBA five man groups. Individual Background Survey scores were higher for number 1 MBA five man groups on Leader and Guidance, and four man groups on Guidance and Best Ideas. TAB

N66-39683# Human Engineering Labs., Aberdeen Proving Ground, Md.
TARGET OBSCURATION FROM INTERVENING LIGHT SOURCES: A PRELIMINARY INVESTIGATION
Andrew J. Eckles III and Thomas A. Garry. May 1966. 20 p
(TN-2-66; AD-637720) CFSTI: HC $1.00/MF $0.50

The preliminary experiment examined how an intervening light source affects target obscuration. More specifically, this experiment estimated how target obscuration depends on variables such as target brightness, intensity of intervening light source, target range, and range of the intervening light source. These results, while limited to data from two subjects, point the way to more detailed and sophisticated experimentation. (Author) TAB

N66-39688*# Hazleton Labs., Falls Church, Va.
RADIOISOTOPIC BIOCHEMICAL PROBE FOR EXTRATERRESTRIAL LIFE Fifth Annual Progress Report
Gilbert V. Levin and Norman H. Horowitz. Oct. 1966. 116 p refs
(Contract NASr-10)
(NASA-CR-78991) CFSTI: HC $4.00/MF $1.00 CSCL 06B

Instrumentation and field testing of the Mark IV model of the Gulliver radioisotopic biochemical probe for extraterrestrial life are described. Despite the good results of the field test, the model demonstrated a sensitivity exceeding that of the current instrument by approximately 2-1/2 orders of magnitude. An account is given for this loss of sensitivity, which is a trade-off for various advantages in reliability, simplicity, and weight-saving aspects of the instrument. A statistical summary for the five-year Gulliver program is presented. Results obtained from tests of all types, except those in which mechanical failure or contamination of the controls occurred, are included. Factors influencing the instrumentation such as size, mass, sterilization, and launch, space, and planetary environments are considered. The design and fabrication of the mechanical and electronic components is also discussed. S.P.

N66-39689*# Chicago Univ., Ill.
INTEGRATED RESEARCH AND TRAINING IN SPACE-MOLECULAR BIOLOGY Semiannual Progress Report, Apr. 1-Sep. 30, 1966
Humberto Fernandez-Moran [1966] 15 p refs
(Grant NsG-441-63)
(NASA-CR-78937) CFSTI: HC $1.00/MF $0.50 CSCL 06F

Continuing efforts are reported for a research program on electron microscopy with high-field superconducting solenoid lenses. Development of a cryo-electron microscope optical bench system and a special superconducting objective lens in liquid helium cryostat is described. Other experimentation included systematic use of ultrathin carbon films prepared by evaporation in ultrahigh vacuum and examination by electron microscopy and electron diffraction of materials collected by the Luster sounding rocket. Also reported is the continuad maintenance of the special electron microscope laboratories with clean room facilities. S.P.

N66-39790# School of Aerospace Medicine, Brooks AFB, Tex.
FACTORS IN JOB-SATISFACTION: ANALYSIS OF SPONTANEOUS COMMENTS
George K. Cantrell, Bryce O. Hartman, and Lewis S. Sims, Jr. (Mil. Airlift Command, Scott AFB, Ill.) Jun. 1966. 18 p ref
(SAM-TR-66-57; AD-637882) CFSTI: HC $1.00/MF $0.50

Comments, spontaneously entered on 2122 questionnaires administered to maintenance airmen in 20 different military units in the Far East, Europe, and the Continental United States, were analyzed. The 4841 comments were assigned to one of 32 different categories and to one of three different levels of emphasis. The analysis supported an earlier finding that an airman's immediate supervisor has a greater capacity to affect his level of job-satisfaction than any other single factor. The more significant problems, including promotion, pay, duty time-time off, duty assignments, poor supervision, management, recognition, living conditions, and supply, are discussed in reference to airmen and to NCO's. The analysis revealed that as an airman changed his level of emphasis in making a comment, his ranking of the comment areas also changed. Author (TAB)

N66-39793# School of Aerospace Medicine, Brooks AFB, Tex.
EVALUATION OF TWO PERCENT GOLD VISOR
John A. Carpenter and Everett O. Richey. Aug. 1966. 11 p
(SAM-TR-66-71; AD-638623) CFSTI: HC $1.00/MF $0.50

A flight evaluation was conducted to determine if use of the 2% gold visor in daylight hours degraded performance of flight duties. Thirteen TAC instructor pilots flew 17 sorties, representative of TAC mission profiles, in the F4C aircraft at Davis-Monthan AFB, Ariz. Slightly diminished vision under cloudy conditions was experienced by some individuals. Satisfactory completion of the missions was accomplished, however. The 2% gold visor is recommended for use in TAC aircraft during daylight hours for eye protection from nuclear detonations. Author (TAB)

N66-39799# School of Aerospace Medicine, Brooks AFB, Tex.
FACTORS IN JOB-SATISFACTION
George K. Cantrell, Bryce O. Hartman, and Lewis S. Sims, Jr. (Mil. Airlift Command, Scott AFB, Ill.) May 1966. 41 p ref
(SAM-TR-66-46; AD-637861) CFSTI: HC $2.00/MF $0.50

A 44-item questionnaire, covering twenty-eight management problem areas, was administered to personnel at twenty different maintenance units in the Far East, Europe, and the Continental United States. Completed questionnaires from 2122 airmen were used to evaluate the relationship between each problem area and job-satisfaction. The analysis showed that job-satisfaction is most affected by those problems that could be controlled or corrected by the immediate supervisors and least affected by those problems which have to be solved at levels farther up the chain of command. Supporting evidence was obtained from interviews and a special psychiatric study. Author (TAB)

N66-39846# Aerospace Medical Div., Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.
OPTIMUM ANGULAR ACCELERATIONS FOR CONTROL OF A REMOTE MANEUVERING UNIT Technical Report, Jun.-Aug. 1965
Herbert J. Clark. Mar. 1966. 36 p refs
(AMRL-TR-66-20; AD-637170) CFSTI: HC $2.00/MF $0.50

Six subjects successfully reoriented the attitude of a simulated remote maneuvering unit (RMU) using an on-off acceleration command control system. RMU attitude was determined solely by viewing the space scene being televised by the RMU. That scene consisted of a spherical target, the earth horizon, and a star background, all of which interacted realistically as a function of the subjects RMU control inputs. The RMU was controlled under three conditions of angular acceleration: 4, 8, and 12 degrees/sec sq. Four deg/sec sq. resulted in least expenditure of fuel and most accurate rate control without a sacrifice in time. These results and subjects preference data recommended pitch, yaw, and roll accelerations of 4 deg/sec sq. when using an on-off acceleration command control system. Subjects relied primarily on the orientation of the earth horizon for RMU roll reference. Because the horizon was not always in view, errors in roll were significantly greater than those in pitch and yaw. This result may have been an artifact of the simulation; too few stars were simulated to allow their use as an adequate roll reference. Simultaneous or separate attitude control resulted in equally effective RMU reorientation. Similarly, pilots and nonpilots performed equally well. However, pilots can usually be trained faster than nonpilots. (Author) TAB

N66-39850 # Antioch Coll., Yellow Springs, Ohio.
A STUDY OF ONE-HANDED LIFTING Final Report
John T. Mc Conville and H. T. E. Hertzberg (AMRL) Wright-Patterson AFB, Ohio, AMRL, May 1966 24 p refs
(Contract AF 33(616)-6792)
(AMRL-TR-66-17; AD-637764) CFSTI: HC $1.00/MF $0.50

The research study is intended to aid in establishing realistic criteria for size and weight of industrial packages. Size and weight, objective and subjective factors that potentially affect human weight-lifting, and proper approach to the design of industrial loads are discussed. Additional programs of investigation that would clarify other aspects of the problem are outlined. This study examined the interaction of two variables--weight and width--of one--handled, symmetrical boxes that a sample of 30 adult males were able to lift from the floor to a table 30 inches high. No carrying was invvolved. The subject sample was chosen to be a reasonable representation by height and weight of the U. S. Air Force population. All lifts were made with the preferred hand under ideal laboratory conditions. Box width was varied from 6 to 32 inches. The maximum weight of box that subjects were able to lift varied linearly, but inversely, with the width of the box. From this sample, the maximum weight that 95% of the population would be able to lift--but not necessarily carry--can be expressed by a linear equation: Y = 60 -X, were Y is the weight (in pounds) of the package to be lifted and X is the width (in inches). The numerical values of this formula provide a recommended upper limit on the design of industrial or military equipment which must be lifted under ideal conditions. If the expected conditions of use are less than ideal, or if carrying for appreciable distances is likely to be necessary, reasonable reductions in weight, or size, or both should be made by the manufacturer. (Author) TAB

N66-39860# Illinois Univ., Urbana. Aviation Psychology Lab.
THE FORGETTING OF INSTRUMENT FLYING SKILLS AS A FUNCTION OF THE LEVEL OF INITIAL PROFICIENCY
Robert F. Mengelkoch, Jack A. Adams, and Charles A. Gainer Port Washington, N. Y., Naval Training Device Center [1965] 132 p refs
(Contract N61339-126)
(NAVTRADEVCEN-71-16-18; AD-637570) CFSTI: HC $4.00/MF $1.00

The four-months interval of non-practice resulted in considerable decrements in the discrete procedural aspects of flight. If these decrements occurred in actual flying situations they would have grave consequences for operational capability and safety. As for the continuous flight control aspects of flight, forgetting occurred only occasionally and in amounts considered of little practical significance by the investigators. The differential effect of non-practice on procedural versus flight control tasks was observed even where the two types of tasks were carried on simultaneously. In most instances there was no relationship between amount forgotten and initial level of flying proficiency. That is, at the end of the four-months interval the high initial training group retained its superiority over the intermediate initial training group. Author (TAB)

N66-39863# Naval Medical Research Inst., Bethesda, Md.
AN EVALUATION OF THE FOAMED NEOPRENE "DIVER'S WET SUIT" AS A SURVIVAL GARMENT FOR HELICOPTER AIRCREWS Research Report no. 7
Elizabeth Reeves, Melvin P. Stephens, and Edward L. Beckman Jul. 1966 35 p refs
(MF-011-99-1001; AD-637153) CFSTI: HC $2.00/MF $0.50

The type of flights performed by helicopters require particular garments for their aircrews as follows: (1) Water entry by aircrew is by way of water collision so that there is a high probability of damage to the survival garment; (2) The short flight radius of the helicopter ensures that the time-distance from a potential rescuer should be relatively short, so that rescue should be expected in less than 4 hours; (3) The suit must be wearable without an air ventilated suit for cooling and still be usable in high cockpit temperatures up to 90F; and, (4) The low altitude of flight allows no time to don or zipper up a survival garment so that there should be no significant penalty for entering the water with the garment partially unzipped. Laboratory experiments using a variety of antiexposure assemblies demonstrated that the 3/16 inch, foamed neoprene wet suit, mittens, hood, and insulated rubber thermal boots provided the most comfortable and efficient configuration. Tolerance times were established for such clothing in 40, 50, and 60F. water Author (TAB)

N66-39876# United Kingdom Atomic Energy Authority, Harwell (England). Radiological Protection Div.
PHYSIOLOGICALLY SAFE WORKING CONDITIONS FOR MEN WEARING PRESSURISED SUITS
R. P. Rowlands Jun. 1966 82 p refs
(AHSB/RP/-R-70)

Experiments investigating the basic principles of thermal stress in pressurized suits has been carried out and from the results three formulas have been derived. Two of these provide a means of predicting the level of thermal stress, which is quantified as an index, in given work situations, and the third predicts the rate of sweating. Other physiological responses, i.e., body temperature and heart rate, are obtained from consideration of the zones into which the values of the index of thermal stress are divided. Control charts are given for a variety of conditions whereby the appropriate rate of supply of breathing air can be chosen to maintain thermal conditions in the comfortable zone where the body temperature is unlikely to exceed 37.8°C (100°F) and the rate of sweating is about 400 g/h. Use of the control charts permits appreciable flexibility in the management of pressurized suit operations; factors such as the thermal environment of the pressurized suit facility, the type of suit, the work task, and the need for rest pauses, can be considered objectively. It is shown that while a breathing air supply rate of 3 ft^3/min. could be satisfactory at temperatures of 15°C, some 10 ft^3/min. of air could be required at 25°C. Author

N66-39893*# Systems Technology, Inc., Hawthorne, Calif.
A "CRITICAL" TRACKING TASK FOR MAN-MACHINE RESEARCH RELATED TO THE OPERATOR'S EFFECTIVE DELAY TIME. PART I: THEORY AND EXPERIMENTS WITH A FIRST-ORDER DIVERGENT CONTROLLED ELEMENT
H. R. Jex, J. D. Mc Donnell, and A. V. Phatak Washington, NASA, Nov. 1966 116 p refs
(Contract NAS2-2288)
(NASA-CR-616) CFSTI: HC $3.00/MF $0.75 CSCL 05H

A first-order divergence is used as the controlled element to obtain certain theoretical advantages. Based on recent human response research, a theoretical analysis of this man-machine system is performed, and an experimental program is described which enables describing function and critical task measures to be compared. A specific critical task mechanization and operating procedure is developed which yields consistent and reliable measurements of the critical levels of instability. An analysis of the describing function results shows that, when operating near criticality, the subject's behavior is adequately represented by recently developed human operator describing function models and adaptation laws. Further, the extrapolation of describing function data to the critical level of instability shows that the operator consistently loses control at small, but finite, mean stability margins. The just-controllable first-order divergence is shown to be related dominantly to the operator's effective time delay, and secondarily to the nominal variations of his average tracking characteristics and to mid-frequency phase lags due to long period kinesthetic adaptation effects. Author

N66-39895*# Little (Arthur D.), Inc., Cambridge, Mass.
THERMAL MANIKIN
Frank Gabron and John Mc Cullough Washington, NASA, Nov. 1966 43 p refs
(Contract NAS9-3554)
(NASA-CR-644) CFSTI: HC $2.00/MF $0.50 CSCL 06B

Fabrication and qualification tests of an anthropomorphic thermal manikin and temperature logging-power control system are reported. This equipment was designed to simulate regional heat losses at relatively low skin temperatures where sweating is not present. The thermal manikin is divided into 17 thermally isolated regions in order to permit the simulation of heat loss variations which exist over different body regions. Each region of the manikin is equipped with a platinum resistance thermometer and resistance heating elements which are used to simulate metabolic rates. The temperature logging-power control system comprises three basic elements, a system electronics console, a digital computer, and an IBM typewriter. S.P.

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N66-39005# Bureau of Mines, Bartlesville, Okla. Petroleum Research Center.
MASS AND INFRARED SPECTRA OF SELECTED UNSATURATED HYDROCARBONS AND OXYGENATES
Ronald F. Kendall and B. H. Eccleston 1966 118 p refs
(BM-RI-6854)

Only a limited number of mass and infrared reference spectra of high purity unsaturated hydrocarbons and oxygenates are presently available in the literature. To aid research programs requiring such references, 64 mass spectra and 70 infrared spectra were obtained and are reported. The individual compounds, acquired from commercial sources, were purified by preparatory gas chromatography. Purity determinations were made using a combination of analytical gas chromatography, microhydrogenation, and catalytic deoxygenation. These spectra will aid spectroscopists in the identification of compounds of the types reported. Author

N66-39099# Atlantic Research Corp., Alexandria, Va. Kinetics and Combustion Group.
RESEARCH ON THE DEFLAGRATION OF HIGH-ENERGY SOLID OXIDIZERS Quarterly Technical Summary Report No. 2, Mar. 1–May 31, 1966
G. Von Elbe 30 Jun. 1966 24 p refs
(Contract AF 49(638)-1645)
(AFOSR-66-1758; AD-637562) CFSTI: HC $1.00/MF $0.50

Experimental work on the decomposition kinetics of ClO2 was completed. The stable intermediate responsible for the delayed chain-branching explosion was established as a previously unknown chlorine oxide, Cl2O3. This new compound was synthesized and characterized and its role in ClO2 explosions investigated. The explosive decomposition was studied from 65C to 134 C, and the effect of vessel size determined. A kinetic interpretation of the results is in progress Author (TAB)

N66-39139# Stanford Research Inst., Menlo Park, Calif.
THERMAL DIFFUSIVITY OF AMMONIUM PERCHLORATE
W. A. Rosser, S. H. Inami, and H. Wise [1964] 17 p refs Sponsored by ONR
(AD-614081) CFSTI: HC $1.00/MF $0.50

A method has been developed to measure the thermal diffusivity of poorly conductive materials. The method is absolute and rapid, and requires only small samples; tests of materials with known thermal properties confirm its accuracy. The thermal diffusivity of compressed NH_4ClO_4 powders has been measured as a function of porosity, particle size, and temperature. Author (TAB)

N66-39176# Union Carbide Nuclear Co., Oak Ridge, Tenn. Nuclear Div.
DETERMINATION OF ALUMINUM, SILICON, IRON, URANIUM, AND THORIUM IN BERYLLIUM BY X-RAY FLUORESCENCE
G. E. Walden and Alma D. Condrey 19 Jul. 1966 23 p refs
(Contract W-7405-ENG-26)
(Y-1542) CFSTI: HC $2.00/MF $0.50

X-ray emission spectroscopy has been successfully applied to the determination of Al, Si, Fe, U, and Th in Be. Be metal was converted by pyrohydrolysis to the oxide and the oxide pressed into a hygienically safe pellet using a thermal-setting resin as a binder. Concentration levels for all elements except Al were those normally encountered in Be metal. Al concentration was determined at levels up to 1.0%. Author (NSA)

N66-39262# Mound Lab., Miamisburg, Ohio.
MOUND LABORATORY PROGRESS REPORT FOR AUGUST, 1966
J. F. Eichelberger, G. R. Grove, and L. V. Jones 23 Feb. 1965 27 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1287) CFSTI: HC $2.00/MF $0.50

X-ray diffraction patterns of an eight-month old sample of an isotopic mixture of $^{208}Po/^{209}Po$ were identical to the alpha phase of ^{210}Po metal. Apparently, the face-centered cubic PbPo which grows acts as a seed for the growth of the alpha phase. Material of molecular mass 18 has steadily accumulated in the 12-column, 8-stage methane thermal diffusion system. Infrared analysis showed conclusively that this material was $^{13}CH_3D$. It appears that the $^{13}CH_3D$ forms in the thermal diffusion system by an exchange reaction between $^{13}CH_4$ and $^{12}CH_3D$. Two CO_2-carbamate exchange-reaction runs were carried out using mixed amine solutions. The results were inclusive because the carbamate did not dissociate completely. A 12-in. cylindrical charcoal trap reduced the tritium level of product ^3He from 2.5 × 10^{-8}% to 6.4 × 10^{-11}%. The new three-column neon tube bundle is being checked in preparation for start-up. It should enrich 10% intermediate ^{21}Ne to above 70%. The five-stage Ar cascade has built up an ^{38}Ar peak of approximately 28%. The fourth pass for enriching ^{86}Kr was made. Over 89% ^{86}Kr was accumulated. The new 24-column six-stage thermal diffusion cascade system constructed in two tube bundles (water jackets) was started using natural Xe as feed. The heats of adsorption of Kr and Xe on Linde Molecular Sieve 5A, 50/60 mesh were calculated to be −1208 and −1901 cal/mole, respectively, based on separations using N as the carrier gas. Discrepancies between theory and experiment for recent thermal diffusion column experiments with Ne can be explained by a stagnant gas barrier in the column. The accuracy of molecular collision integrals for gases was investigated. The possibility of maintaining a relatively constant level of liquid He in a pumped bath for use in the distillation separation of ^3He and ^4He was investigated. Research is in progress to determine the reason for differences in measured thermomolecular pressure in He by different investigators. A direct reader procedure was developed for the determination of Be in Air. A direct reader procedure was developed which could detect impurities in Au at levels below 6 × 10^{-5} mg. The total shrinkage of Eastman 910 adhesive (methyl 2-cyano-acrylate) was determined using thermal, free-radical and anionic polymerization conditions. NSA

N66-39289*# Minnesota Univ., Minneapolis. Physical Electronics Lab.
THE BAONI MATRIX CATHODE FORMED BY THE NICKELATE TECHNIQUE

T. J. Szczech and D. E. Anderson [1966] 22 p refs Presented at the 8th Natl. Conf. on Tube Tech., New York, 22 Sep. 1966 (Grant NGR-24-005-063; Contract AF 33(657)-10475) (NASA-CR-78748) CFSTI: HC $1.00/MF $0.50 CSCL 07B

The properties of an indirectly-heated cathode produced by reacting barium carbonate and nickel oxide on nickel are described. A eutectic melt of nickel oxide and barium nickelate occurs as a necessary step in the preparation of the cathode. Reduction of the nickel oxide and barium nickelate into nickel and barium oxide by using hydrogen at an elevated temperature is also necessary. Studies using X-ray diffraction techniques and an electron beam microprobe indicate that the cathode consists of a uniform mixture of nickel and barium oxide. Thermionic emission data taken after vacuum lifting of various cathodes, including carbon-activated cathodes, and after sputtering of the surfaces will be presented. A discussion of some of the theoretical aspects of the formation techniques and of the operation of the cathode in various environments will be presented. Author

N66-39368# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON CONVERGENCE OF EXPERIMENTAL VALUES OF SPECIFIC HEAT BENZOIC ACID BETWEEN 14 AND 90°K WITH APPLICATION OF DIFFERENT TEMPERATURE SCALES

A. A. Skiyankin and P. G. Strelkov *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 282–286 refs (See N66-39346 24-23) CFSTI: HC $7.00/MF $1.50

A comparison is presented of the influence of using different temperature scales in specific heat calculations, with the influence of scale and all experimental errors in the given measurements. These values are analyzed, and it is concluded that the reproducibility of standard values of entropy and enthalpy can be guaranteed within 0.1% regardless of temperature scale, if the error of extrapolation of 0°K can be avoided. A.G.O.

N66-39402# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PHYSICAL CHEMISTRY INSTITUTE. PROBLEMS OF PHYSICAL CHEMISTRY (SELECTED ARTICLES)

2 Mar. 1966 45 p refs Transl. into ENGLISH from Fiz.-Khim Inst. Probl. Fiz. Khim. (Moscow), no. 3, 1963, p 66–85 (FTD-MT-65-226; TT-66-62030; AD-637053) CFSTI: HC $2.00/MF $0.50

CONTENTS:

1. MASS SPECTROMETRIC METHODS OF DETERMINING SMALL QUANTITIES OF IMPURITIES S. Ye. Kupriyanov p 1–18 refs (See N66-39403 24-06)

2. DOUBLE MASS SPECTROMETER FOR THE INVESTIGATION OF DISSOCIATION OF IONS DURING COLLISION WITH ATOMS AND MOLECULES OF DIFFERENT GASES S. Ye. Kupriyanov p 19–35 refs (See N66-39404 24-06)

N66-39403# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

MASS SPECTROMETRIC METHODS OF DETERMINING SMALL QUANTITIES OF IMPURITIES

S. Ye. Kupriyanov *In its* Phys. Chem. Inst. Probl. of Phys. Chem. 2 Mar. 1966 p 1–18 refs (See N66-39402 24-30) CFSTI: HC $2.00/MF $0.50

(1) Basic methods of increasing the sensitivity of mass spectrometric analysis of gases are examined. It is noted that in certain cases sensitivity of the order of 10^{-5}% can be attained on the usual analytic mass spectrometers, without their essential alteration. Higher sensitivity can be obtained only as a result of considerable modernization of the instrument and at that only in separate cases. For the production of still higher sensitivity (10^{-3}% [sic] and above) the construction of a very complicated and bulky mass spectrometer is necessary. (2) By combining other methods and applications (for instance, preliminary enrichment of analyzed samples, and others) with mass spectrometric analysis, high sensitivity can be obtained even on relatively simple mass spectrometers, pumped to deeper vacuum (10^{-10} mm Hg) than is usually accomplished. Author

N66-39404# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DOUBLE MASS SPECTROMETER FOR THE INVESTIGATION OF DISSOCIATION OF IONS DURING COLLISION WITH ATOMS AND MOLECULES OF DIFFERENT GASES

S. Ye. Kupriyanov *In its* Phys. Chem. Inst. Probl. of Phys. Chem. 2 Mar. 1966 p 19–35 refs (See N66-39402 24-30) CFSTI: HC $2.00/MF $0.50

A double mass spectrometer, consisting of an ion source, two electromagnetic analyzers between which the collision chamber was located, and two ion receivers was utilized to investigate the dissociation of the ions CH_4^+, CH_3^+, CH_2^+, and CH^+ in various gases. Intensities of the characteristic peaks in the mass spectra were measured by heights. It was found that all dissociation processes of the ions, at least at gas pressures of the order of 5×10^{-5} mm Hg, were caused by single collisions of atoms and molecules. Relative disintegration probabilities depended insignificantly on the mass and type of neutral particle during collision. Dissociation of CH^+_4, CH^+_3, CH^+_2, and CH^+ ions during collision of atoms and molecules occurred both because of electron excitation and the transition of some kinetic energy of the ions into oscillatory. The cross section of the process $CH_4^+ \rightarrow CH_3^+ + H$ was about 7×10^{-16} cm^2. G.G.

N66-39459# Atlantic Research Corp., Alexandria, Va. Kinetics and Combustion Group.

RESEARCH ON THE DEFLAGRATION OF HIGH-ENERGY SOLID OXIDIZERS Quarterly Technical Summary Report No. 1, 1 Dec. 1965–28 Feb. 1966

G. von Elbe 31 Mar. 1966 32 p refs (Contract AF 49(638)-1645) (AFOSR-66-1377; AD-637561) CFSTI: HC $2.00/MF $0.50

The task of the program is fundamental research on advanced solid oxidizers with the aim of understanding their self-deflagration. Hydrazine perchlorate and hydrazine diperchlorate have received, of late, most of the attention. Effort was devoted to elucidating some of the chemistry involved in the deflagration process. Toward this end, a literature review of the thermal behavior of hydrazine and perchloric acid was carried out. This was extended to include a review of reactions of chlorine oxides. The kinetics and mechanisms of the latter compounds, it was discovered, are not very well understood. Hence, some experiments were performed on ClO2 and ClO3, two species which seem likely to be important in oxidizers encountered in the program. In particular we have concentrated on the explosive decomposition of ClO2. It was found to explode by a degenerate chain-branching mechanism at all temperatures and pressure above 54C and a few tenths of a mm Hg. Very long induction periods were observed, and ClO3 was shown to be a critical intermediate. The explosion is promoted by irradiation and by addition of foreign gases. Author (TAB)

N66-39496# Vanderbilt Univ., Nashville, Tenn.

COORDINATION, LIGRAND REACTIVITY AND CATALYSIS Final Scientific Report, Period Ending Jun. 30, 1966

Mark M. Jones, Charles J. Bennett, David O. Johnston, Don G. Lambert, and John H. Hosking [1966] 13 p refs (Grant AF-AFOSR-630-64) (AFOSR-66-1751; AD-637565) CFSTI: HC $1.00/MF $0.50

The ways in which coordination may alter the rates or reaction paths of typical ligand reactions were studied. Emphasis was placed on the possibility that coordination might provide a masking for ligands to prevent their attack by otherwise effective oxidants. The possibilities that coordination might provide information on some reaction mechanisms or provide a path to facilitate a reaction were also studied. Examples of all of the above reactions were found and data collected. Author (TAB)

N66-39500# American Meteorological Society, Boston, Mass.
PRESSURE-TEMPERATURE DIAGRAM OF PART OF THE SiO_2–H_2O SYSTEM
I. A. Ostrovskii, G. P. Mishina, and V. M. Povilaitis Bedford, Mass., AFCRL, Jun. 1966 11 p refs Transl. into ENGLISH from Izd-Vo Akad. Nauk SSSR (Moscow), v. 1, 1961 p 641–646
(Contract AF 19(628)-3880)
(T-R-628; TT-66-62121; AD-637467) CFSTI: HC $1.00/MF $0.50

The PT-Projection of the high temperature part of the system SiO_2–H_2O is based on experimental data. The results agree with the theoretically possible scheme of combination of stable and unstable invariant points in a n=−1 multisystem according to Korzhinskii. In case of low water concentration, quartz, as a stable phase, may coexist with the melt at temperatures above 1300C. Cristobalite and tridymite are unstable at pressures higher than about 2500 atm. Author (TAB)

N66-39515# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
KINETICS OF THERMAL DECOMPOSITION OF SOLIDS
G. A. Razumov, B. I. Brounshteyn, and A. A. Kane 26 Mar. 1966 19 p refs Transl. into ENGLISH from the book "Raboty po Termodinamike i Kinetike Khimicheskikh Protsessov" Moscow, Gos. Kom. Sov. Min SSSR po Khim., 1962 p 170–182
(FTD-TT-65-1605; TT-66-62107; AD-637434) CFSTI: HC $1.00/MF $0.50

It is shown that Yerofeyev's equation, which is commonly used for practical purposes, cannot correctly describe the process of thermal decomposition of inorganic crystals, since it applies only to the case of a reaction in a continuous medium, when the nuclei are formed in the volume. During the thermal decomposition of crystals, the nuclei are formed only on their surface. A solution is given for the problem involving the calculation of the probability of the reaction at a given point of the solid pnd for the general case of a solid of any shape and for an arbitrary law of formation of nuclei not only on the surface of the solid but also in its volume. The exact solution obtained is analyzed in two limiting cases, and it is shown that the total activation energy depends not only on the nature of the substance, but also on the size and shape of the particles. The theory of similitude was used to find two dimensionless variables which determine the process of thermal decomposition. Author (TAB)

N66-39550# Spinedi (Paolo), Rome (Italy).
RESEARCH INTO THE CHEMICAL BEHAVIOUR OF SURFACES OF SINGLE-CRYSTALS, BI-CRYSTALS AND TRI-CRYSTALS UNDER DIFFERENT EXPERIMENTAL CONDITIONS Quarterly Technical Status Report, 1 Jul.–30 Sep. 1965
Paolo Spinedi Sep. 1965 11 p
(Contract DA-91-591-EUC-3593)
(QTSR-1; AD-637293) CFSTI: HC $1.00/MF $0.50

Progress in the following research areas is summarized: (1) use of an electron emission microscope for the study of crystal surface reactivity; (2) potentiostatic studies of the electrochemical behavior of crystal surfaces. TAB

N66-39581# Texaco Experiment, Inc., Richmond, Va.
FLASH PHOTOLYSIS OF $CINF_2$ AND $FNCl_2$
P. L. Goodfriend and H. P. Woods 1 Jul. 1966 9 p refs
(Contract Nonr-1883(00))
(TP-282; EXP-223; AD-637169) CFSTI: HC $1.00/MF $0.50

Flash photolysis-kinetic spectroscopy experiments were performed on CINF2 and FNCl2. In the case of CINF2, no transient spectra were observed, but only permanent changes in the spectrum due to decomposition of the molecule. In the case of FNCl2, a transient band system between 3400A and 3900A was observed, with maximum intensity at a delay time of 150 micro sec. Features fall into a progression with an interval of about 360/cm, which probably represents a bending frequency in the excited electronic state. The carrier of this band system is unknown. Associated with the band system is a continuous absorption on the short wave length side Author (TAB)

N66-39582# Dow Chemical Co., Midland, Mich.
HALOALUMINIUM HYDRIDES AND DEUTERIDES DITETRAHYDROFURAN ADDUCTS
D. L. Schmidt and E. E. Flagg Jun. 1966 18 p refs
(Contract Nonr-4968(00))
(TR-1; AD-637258) CFSTI: HC $1.00/MF $0.50

Tetrahydrofuran adducts of haloaluminum hydrides, A1HyX3-y.z(THF) (X = C1, Br, I), and some deuterated analogs were prepared and characterized. The adducts are crystalline solids which are normally isolated as stoichiometric ditetrahydrofuranates. Cryoscopic and ebullioscopic molecular weight determinations in benzene and THF, respectively, indicate the compounds are monomeric in these solvents. Active hydrogen determinations indicate no initial cleavage of THF. X-Ray powder diffraction patterns indicate that A1H2C1.2(THF), A1HC12.2(THF, A1D2C1.2(THF), A1DC12.2(THF), A1H2Br.2(THF), and A1HC1Br.2(THF) are isomorphous. Infrared frequencies for the A1-H and A1-D bands are reported and their relationship to the structure of the complexes is discussed. Proton magnetic resonance data confirm THF complex formulation. (Author) TAB

N66-39583# McMaster Univ., Hamilton (Ontario). Dept. of Metallurgy and Metallurgical Engineering.
AN ELECTRON MICROSCOPE STUDY OF THE MORPHOLOGY OF LITHIUM FLUORIDE SURFACES FOLLOWING DISSOLUTION IN DILUTE AQUEOUS SOLUTIONS OF FERRIC IONS
T. R. Ramachandran and M. B. Ives Jul. 1966 41 p refs
(Contract Nonr-3925(00))
(TR-7; AD-637274) CFSTI: HC $2.00/MF $0.50

High resolution replica electron microscopy has revealed a complex structre of surface ledges of lithium fluoride crystals after etching in dilute aqueous solutions of ferric chloride. Ledge heights vary from approximately 400A in etchant containing 0.1 ppm ferric ions and are unresolvable at greater than 2 ppm ferric ions. The ledge density is also modified with change in ferric ion content and this has been related to previous studies of adsorption in this system. It is proposed that the ledge structure is due to irregular inhibition by the ferric ions, and the results have been compared with recent theoretical and experimental studies of crystal dissolution Author (TAB)

N66-39597# Ottawa Univ. (Ontario).
ELECTROCHEMICAL STUDIES OF PLATINUM SURFACE OXIDATION IN RELATION TO HYDROCARBON OXIDATION. PARTS I, II, AND III Interim Report, Jan. 1964–Mar. 1966
D. Gilroy, L. Marincic, J. Wojtowicz [1966] 179 p refs
Sponsored by Can. Com. Corp.
(AD-636384)

The contents of the report cover several complementary aspects of work on oxidation mechanisms at the platinum anode with particular reference to oxidation of, or electrochemical adsorption of oxygen-containing species at, platinum and the behaviours of hydrocarbons at the oxidised platinum anode surface. A number of complementary procedures were used in the studies including steady-state measurement, direct and differential galvanostatic studies and potentiodynamic experiments as well as some examination of carbon-14 labelled molecules at the platinised platinum electrode. TAB

N66-39644# Midwest Research Inst., Kansas City, Mo.
BASIC INVESTIGATIONS IN PHOTOPOTENTIOMETRY Technical Report, 1 May 1965–30 Apr. 1966

Donald D. Rosebrook Wright-Patterson AFB, Ohio. AF Mater. Lab., Jul. 1966 36 p refs
(Contract AF 33(615)-2665)
(AFML-TR-66-213; AD-637556) CFSTI: HC $2.00/MF $0.50

A photopotentiometry system was devised and successfully operated. The photopotentials measured in the tris(oxalato)ferrate (III) system compare favorably with potentials calculated from the Nernst equation. The potentials are produced by a mechanism resembling a concentration cell with transference. The effects of temperature and concentration are well defined by the Nernst equation. The observed potential at any time during the irradiation is approximated by a potential calculated from the Nernst equation.
Author (TAB)

N66-39692*# Southern Univ., Baton Rouge, La. Dept. of Chemistry.
THE FORMATION OF SILVER (I) CHLORIDE BY THE ACTION OF SILVER (I) ION ON CARBON TETRACHLORIDE IN 2-BUTANOL AND METHANOL
Ivory V. Nelson, Mazie Le Deaux, and Mary E. Yates [1964] 9 p refs
(Grant NGR-19-005-001)
(NASA-CR-78932) CFSTI: HC $1.00/MF $0.50 CSCL 07C

The reaction of silver (I) ion with carbon tetrachloride in 2-butanol and methanol was studied. In the concentration range studied, the reaction was found to proceed irrespective of solvent.
Author

N66-39703*# Yale Univ., New Haven, Conn.
A MODEL SYSTEM OF REACTING H_2 AND I_2
Philip Rosen and Harold J. Morowitz [1966] 12 p
(Grant NGR-07-004-041)
(NASA-CR-78878) CFSTI: HC $41.00/MF $0.50 CSCL 07D

A mathematical model is presented of a system of reacting H_2 and I_2, at temperature T, which is separated from a similar system, at temperature $T+\Delta T$. Six equations are given which are necessary to calculate the concentrations in the steady state. Using these equations, the kinetics of the defined system are examined.
H.S.W.

N66-39731# Royal Inst. of Tech., Stockholm (Sweden). Physics Dept.
THE IONIZATION OF WATER, METHYLAMINE, AND METHYL ALCOHOL, USING ELECTRON AND ION IMPACT Scientific Report No. 7
H. Sjogren 10 May 1966 34 p refs
(Contract AF 61(052)-762)
(AFCRL-66-593; AD-637661) CFSTI: HC $2.00/MF $0.50

The ionization of H2O was investigated, using charge exchange in a double mass spectrometer. The breakdown graph was constructed. A break in the electron impact ionization efficiency curve is explained as being due to preionization, as its explanation as being due to an ion-molecule reaction between H(+) ions and H2O seems to be less probable. The appearance potential of OH(+) was found to be considerably higher with charge exchange than when electron impact was used, which agrees with an earlier finding that intercombination transitions seem to be more strictly forbidden in charge exchange than in electron impact. CH3NH2 and CH3OH were investigated, using charge exchange at elevated pressures. The breaks in the ionization efficiency curves for these molecules are discussed and ascribed to preionization or secondary processes
Author (TAB)

N66-39777# Picatinny Arsenal, Dover, N. J. Explosives Lab.
LEAD SALTS OF TRINITRO PHENOLS. I: PREPARATION AND PROPERTIES OF METHOXY PICRIC ACID AND LEAD METHOXY PICRATE
T. Richter, E. Sowinski, and M. Warman Aug. 1966 31 p refs
(PA-TR-3344; AD-637154) CFSTI: HC $2.00/MF $0.50

An investigation is made into the synthesis, properties, and chemistry of two new compounds of interest to explosives chemistry, methoxy picric acid and lead methoxy picrate. Methoxy picric acid was synthesized by a new technique, nitration of disulfonic monomethyl resorcinol, after older methods had been tried and abandoned because of their inability to yield the desired product. The synthesis of lead methoxy picrate was successfully accomplished in a nonaqueous medium to yield a compound containing an OPbOH functional group. Nuclear magnetic resonance spectroscopy, infrared spectroscopy, and differential scanning calorimetry were used to characterize the two compounds and to elucidate their chemistry. A series of explosion test values are given for lead methoxy picrate and compared to the corresponding values for n-lead styphnate
Author (TAB)

N66-39839# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.
STUDY BY EXTRACTION OF THE REACTION BETWEEN ARSENIC TRIBROMIDE AND ORGANIC SOLVENTS [ETUDE PAR EXTRACTION DES INTERACTIONS ENTRE LE TRIBROMURE D'ARSENIC ET DES SOLVANTS ORGANIQUES]
Ryszard Olszer and Slawomir Siekierski May 1966 17 p refs In FRENCH; ENGLISH summary
(Rept.-707/V/C) CFSTI: HC $1.00/MF $0.50

The extraction of arsenic tribromide into 20 organic solvents and the complex formation between $AsBr_3$ and some aromatic donors have been studied. The stoichiometry and the stability constants of the addition compounds of $AsBr_3$ with benzene and its derivatives have been determined by the extraction method. Hexane and carbon tetrachloride were used as diluting solvents; the results are discussed in terms of the theory of ideal and regular associated solutions.
Author

N66-39873# European Atomic Energy Community, Ispra (Italy). Chemistry Dept.
ANALYTICAL STUDIES ON SAP [ETUDES ANALYTIQUES SUR LE SAP]
J. L. Collin and G. Serrini Jul. 1966 71 p refs In FRENCH; ENGLISH summary
(EUR-3064.f) CFSTI: HC $3.00/MF $0.75

Various analytical determinations for powders and sintered products of SAP are reported. The following compounds and elements were analyzed: aluminum, aluminum oxide, total and free carbon, carbonate, fats, aluminum carbide, combined nitrogen, hydrogen, water, iron, silicon, zinc and nickel. The analytical results of aluminum oxide, total carbon, iron, silicon and zinc were compared with the findings obtained by other laboratories doing light metal analysis.
Author

N66-39891*# Westinghouse Electric Corp., Baltimore, Md. Aerospace Div.
DIFFUSION OF IMPURITIES INTO SILICON FROM GASEOUS SOURCES
R. M. Mc Louski Washington, NASA, Nov. 1966 28 p refs
(Contract NAS5-2755)
(NASA-CR-524) CFSTI: HC $1.00/MF $0.50 CSCL 07B

This report describes a number of diffusion experiments performed during a development program whose purpose is to obtain additional insight into the effects of gaseous dopants on silicon and, thereby, better control of the resulting surface conditions and resistivity profiles. Experiments performed with diborane, phosphine, and arsine gases as the source of impurities for diffusion in silicon demonstrated their superiority to the conventional solid or liquid diffusion sources. Several means of controlling the deposition sheet resistivity were found to be available, with the time of deposition being the simplest controlling parameter for a given deposition temperature and concentration of oxygen and dopant in the furnace feed gas. The data gathered from the experiments are presented in both tabular and graphical form, and the diffusion systems employed are described. Analyses of the

data and of the diffusion systems indicate that many problems associated with solid and liquid source methods are avoided by the use of the gaseous system. It was found possible to control the sheet resistivity over a wide range of doping levels. Author

N66-39909*# Army Missile Command, Huntsville, Ala. Translation Branch.
POTENTIOMETRIC INVESTIGATION OF THE OXIDATION OF FERROUS CHLORIDE BY OXYGEN
V. V. Lyul'ko 15 Aug. 1966 14 p refs Transl. into ENGLISH from Khim. i Khim. Technol. (USSR), v. 6, 1962 p 911–915
Sponsored in part by NASA, Marshall Space Flight Center
(NASA-TM-X-59023; RSIC-582) CFSTI: HC $1.00/MF $0.50 CSCL 07B

In the oxidation reaction of ferrous chloride by oxygen of the air, the following catalyzers wre investigated: platinated platinum, plantinated asbestos, cupric sulfate, cobaltous chloride, and activated carbon. Activated carbon proved to be the best catalyzer. It was shown that upon increasing the amount of activated carbon from 20g/l to 200g/l the oxidation rate of ferrous chloride increased by approximately four times. A further increase in the amount of activated carbon increases the reaction rate to a lesser degree. It was shown that without a catalyzer, the change of the HCL concentration from 0.50-N to 2.42-N has no effect on the oxidation rate of $FeCl_2$. In concentrated solutions of 6.26-N and 8.52-N hydrochloric acid the oxidation rate sharply increases. Author

N66-39913*# Maryland Univ., College Park. Dept. of Chemistry.
EXPERIMENTAL STUDIES CONCERNING EQUILIBRIUM SYSTEMS IN PRE-BIOLOGICAL ATMOSPHERES Progress Report, Mar. 1–Aug. 31, 1966
Ellis R. Lippincott Oct. 1966 6 p Prepared in Cooperation with Natl. Biomed. Res. Found.
(Grant NGR-21-002-059)
(NASA-CR-79117) CFSTI: HC $1.00/MF $0.50 CSCL 07C

Gas mixtures representing a wide range of C:H ratios were subjected to the plasma discharge. Using gas chromatography techniques, their product mixtures were found to contain a large number of polynuclear aromatic hydrocarbons in small quantities. Commercially available unsubstituted polynuclear aromatic hydrocarbons were run in the gas chromatograph to aid in the identification of these compounds. It was found that the log of the relative retention times gave a straight line when plotted against the boiling points, and a smooth curve when plotted against the number of carbon atoms. These plots, together with chromatograms of the product mixtures, gave data on reaction products for which no standards were available for direct comparison. A number of specific compounds were identified. Several theoretical calculations were made to serve as an aid in evaluating experimental results. Computed equilibrium concentrations of selected compounds which, under certain conditions, should be present in greater than 1% mole fractions, are tabulated. Theoretical and experimental data are presented for the hypothesis that many organic compounds may form under conditions of thermodynamic equilibrium. S.C.W.

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N66-38838# Joint Publications Research Service, Washington, D. C.
TWENTY-SECOND ALL-UNION SCIENTIFIC SESSION DEVOTED TO RADIO DAY. SECTION ON RADIO BROADCASTING, ELECTROACOUSTICS AND SOUND RECORDING
9 Sep. 1966 44 p refs Transl. into ENGLISH of the Russian Publ. "XXII Vsesoyuznaya Nauchnaya Sessiya, Posvyashchennaya Dnyu Radio. Sektsiya Radioveshchaniya, Electroakustiki i Zvukozapisi" Moscow, 1966
(JPRS-37516; TT-66-33944) CFSTI: $2.00

CONTENTS:

1. AUTOMATION OF CONTROL OF THE TRANSMISSION COEFFICIENT ON RADIO BROADCASTING V. A. Nyurenberg and G. Kh. Pan'kov p 1–6 (See N66-38839 24-07)
2. CHARACTERISTICS OF THE SOUND CORES USED IN SOUND AMPLIFICATION SYSTEMS L. Z. Papernov and N. T. Molodaya p 7–12 refs (See N66-38840 24-07)
3. THE INFLUENCE OF ADDITIVE NOISE ON THE ACCURACY OF TRANSMISSION OF PULSE WIDTH MODULATION SIGNALS ON A MAGNETIC RECORDING CHANNEL M. V. Gitlits p 13–19 (See N66-38841 24-07)
4. AN APPROXIMATE METHOD FOR DESIGN CALCULATION OF A MAGNETIC RECORDING SYSTEM FOR PULSE SIGNALS A. I. Viches p 20–24 refs (See N66-38842 24-14)
5. CONDUCTOR HEADS FOR FERROGRAPHY V. I. Yeremichev p 26–27 refs (See N66-38843 24-14)
6. THE PROBLEM OF MAGNETIC RECORDING ON A CARRIER WITH MAGNETIC PENETRABILITY GREATER THAN ONE I. V. Yelagin p 28–30 (See N66-38844 24-14)
7. SOME SPECIAL FEATURES OF OPERATION OF SPECTRA TRANSFORMERS V. M. Charnitser p 31–38 refs (See N66-38845 24-14)

N66-38839# Joint Publications Research Service, Washington, D. C.
AUTOMATION OF CONTROL OF THE TRANSMISSION COEFFICIENT IN RADIO BROADCASTING
V. A. Nyurenberg and G. Kh. Pan'kov *In its* 22d All-Union Sci. Session devoted to Radio Day. Sect. on Radio Broadcasting, Electroacoustics and Sound Recording 9 Sep. 1966 p 1–6 (See N66-38838 24-07) CFSTI: $2.00

Experiments were conducted to obtain objective indices for determining the characteristics of automatic control devices in relation to their reliability under various operational conditions. Two types of transmission signal comparators were studied: the two channel logarithmic comparator, and the comparator–electronic ratiometer. On the average, operating reliability of the two channel comparator for speech transmissions was 0.75 to 0.8 (the range of comparison is 30 dB, the test time is 150 to 450 μsec) in one program, and 0.94 to 1 for two different programs. The electronic ratiometer reliability for voice transmission was 0.6 to 0.7 (the comparison range was 30 dB, the test time 450 to 500 μsec) on one program, and 0.8 to 0.9 for two different programs. Calculated data comparisons with experiments showed that the error for the logarithmic comparator did not exceed 20%. M.G.J.

N66-38840# Joint Publications Research Service, Washington, D. C.
CHARACTERISTICS OF THE SOUND CORES USED IN SOUND AMPLIFICATION SYSTEMS
L. Z. Papernov and N. T. Molodaya *In its* 22d All-Union Sci. Session devoted to Radio Day. Sect. on Radio Broadcasting, Electroacoustics and Sound Recording 9 Sep. 1966 p 7–12 refs (See N66-38838 24-07) CFSTI: $2.00

The characteristics used in evaluating the quality of a sound amplification system are identified as the amplification index, the acoustical ratio at the locations occupied by the listeners, and the

maximum level of the sound field. Two methods for obtaining the information required for the calculations are assessed: the spatial directionalness characteristics taken in the entire operating frequency range, and the average characteristics of directionalness with possible deviations in peak values considered. Experimental details are given, and findings show: (1) The spatial characteristics of directionalness, in relation to the average sound pressure of the sonic cores, may be accurately approximated by a triaxial ellipsoid whose center coincides with the acoustical center of the core. (2) The characteristics of directionalness for peak emission values also may be approximated by a triaxial ellipsoid with smaller eccentricity in the vertical plane. (3) The acoustical power emitted by the core is higher than the frequency of mechanical resonance, and decreases with an increase in frequency.
M.G.J.

N66-38841# Joint Publications Research Service, Washington, D. C.

THE INFLUENCE OF ADDITIVE NOISE ON THE ACCURACY OF TRANSMISSION OF PULSE WIDTH MODULATION SIGNALS ON A MAGNETIC RECORDING CHANNEL

M. V. Gitlits *In its* 22d All-Union Sci. Session devoted to Radio Day. Sect. on Radio Broadcasting, Electroacoustics and Sound Recording 9 Sep. 1966 p 13–19 (See N66-38838 24-07) CFSTI: $2.00

Equations are presented to show that the effect on the signal of additive noise in the channels leads to significantly large errors. The necessity of determining the form of the reproduced signal if ShIM (pulse width modulation) pulses are recorded is pointed out, and an expression is formulated to approximately describe the relative transition function of the reproduction channel. The responses in the ShIM signal which is reproduced is depicted. A diagram is also presented to show the imposition of additive noise on the signal with a level corresponding to one period of the cyclic series of pulses. From a study of this figure for the limitation threshold, a series of equations are constructed. Consideration is also given to systems with demodulation with respect to ratio, in which the magnitude of the resultant error is approximately equal to the difference in the relative errors of the basic and auxiliary parameters.
M.G.J.

N66-38847# Joint Publications Research Service, Washington, D. C.

TWENTY-SECOND ALL-UNION SCIENTIFIC SESSION DEVOTED TO RADIO DAY. SECTION ON TELEVISION

9 Sep. 1966 73 p refs Transl. into ENGLISH of the publ. "XXII Vsesoyuznaya Nauchnaya Sessiya, Posvyashchennaya Dnyu Radio. Sektsiya Televideniya" Moscow, 1966

CONTENTS:

1. CALCULATION OF THE PROBABILITY OF RECOGNITION OF A HALF-TONE IMAGE WHEN TRANSMITTED OVER A CHANNEL WITH NOISE N. N. Krasil'nikov p 1–4 refs (See N66-38848 24-07)

2. THE SIGNAL/NOISE RATIO IN TELEVISION PICKUPS WITH TRANSISTOR VIDEO AMPLIFIERS I. P. Pustynskiy p 5–12 refs (See N66-38849 24-07)

3. COMPARATIVE EVALUATION OF THE NOISE RESISTANCE OF AM (AMPLITUDE MODULATION) AND PCM (PULSE CODE MODULATION) IN THE CASE OF IMAGE TRANSMISSION V. Ya. Sorin p 13–17 ref (See N66-38850 24-07)

4. SELECTION OF THE OPTIMAL AMPLITUDE CHARACTERISTICS OF THE IMAGE TRANSMITTER AND RECEIVER FROM THE POINT OF VIEW OF NOTICEABILITY OF NOISE L. P. Yaroslavskiy p 18–22 refs (See N66-38851 24-07)

5. EXPERIMENTAL STANDARD TELEVISION SIGNAL CONVERTER S. I. Katayev, V. G. Makoveyev, V. V. Smirnov, E. V. Dymnich, and G. A. Avanesov p 23–26 (See N66-38852 24-07)

6. DESIGN PRINCIPLES FOR THREE-BEAM KINESCOPES OF THE CHOMATRON TYPE A. P. Angaforov p 27–32 (See N66-38853 24-09)

7. THE PROBLEM OF SELECTION OF THE FREQUENCY OF THE COLOR SUBCARRIER A. I. Sharov p 33–37 refs (See N66-38854 24-07)

8. RECEIVING COLOR ON A BLACK AND WHITE KINESCOPE V. Ya. Chuyev p 38–42 refs (See N66-38855 24-07)

9. THE RANGE OF COLORS AND THE COLOR EFFECT ON A BLACK AND WHITE KINESCOPE V. Ya. Chuyev p 43–47 refs (See N66-38856 24-07)

10. THE FINE STRUCTURE OF THE ENERGY SPECTRUM OF A TELEVISION SIGNAL N. K. Milenin p 48–52 refs (See N66-38857 24-07)

11. CALCULATION OF THE NUMBER OF DEGREES OF BRIGHTNESS REPRODUCIBLE BY THE SYSTEM FOR TRANSMISSION OF AN IMAGE WITH A GIVEN VALIDITY CRITERION G. A. Nozdrunkov p 53–59 refs (See N66-38858 24-07)

12. LINE SCANNING USING THYRISTORS V. F. Mosina and M. N. Shuvalova p 60–66 refs (See N66-38859 24-07)

13. PROBLEMS IN AUTOMATION OF THE CONTROL OF THE PARAMETERS OF TELEVISION RECEIVER TUBES IN MASS PRODUCTION A. D. Kostinskiy p 67–71 refs (See N66-38860 24-09)

N66-38848# Joint Publications Research Service, Washington, D. C.

CALCULATION OF THE PROBABILITY OF RECOGNITION OF A HALF-TONE IMAGE WHEN TRANSMITTED OVER A CHANNEL WITH NOISE

N. N. Krasil'nikov *In its* 22d All-Union Sci. Session devoted to Radio Day. Sect. on Television 9 Sep. 1966 p 1–4 *refs* (See N66-38847 24-07) CFSTI: $3.00

The problem of recognizing a half-tone image by an observer in the presence of a fluctuating noise is considered. The probability of recognizing a half-tone image is reduced to a calculation of the probability of recognizing a two-shaded image. The transmission of the half-tone using a pulse code modulation system is considered. The image is first converted from a purely half-tone image into a discriminated image with respect to brightness and elongation, both lengthwise and across the rows. The noise turns out to be also quantified with respect to brightness and elongation. The first situation leads to the occurrence of a finite number of brightness drops which in the case of simply connected outlines equals $(m-1)$ where m is the number of quantification levels. The case dealing with multiconnected outlines may be reduced to the case of simply connected outlines. The second situation leads to having W expressed as a delta function, where W is defined by the scale of the transmitted image, its contrast, the aperture and light characteristics of the system, the noise spectrum, the signal/noise ratio, and other secondary characteristics of the system.
R.N.A.

N66-38849# Joint Publications Research Service, Washington, D. C.

THE SIGNAL/NOISE RATIO IN TELEVISION PICKUPS WITH TRANSISTOR VIDEO AMPLIFIERS

I. P. Pustynskiy *In its* 22d All-Union Sci. Session Devoted to Radio Day. Sect. on Television 9 Sep. 1966 p 5–12 refs (See N66-38847 24-07) CFSTI: $3.00

The construction of transistor video amplifiers for television pickups is difficult because of an increase in the level of characteristic noise in the semiconductor triodes. The determination of the quantitative dependency of the signal/noise ratio of the preliminary video amplifiers on the parameters of the triodes and the conditions of their operation in various switching systems is of particular interest. The noise properties of television pickups with transistorized video amplifiers are considered taking into account all the basic factors which affect the quantitative evaluation of the signal/noise ratio. Expressions are given which show that the

noise properties of television pickups with an amplifier input cascade regarding a system with a master emitter as well as with a master collector are practically identical. The noise is determined by the parameters of the diode and the magnitude of the current. Preference should be given to the system which more easily provides the required stability, i.e. the system with a master collector. R.N.A.

N66-38850# Joint Publications Research Service, Washington, D. C.

COMPARATIVE EVALUATION OF THE NOISE RESISTANCE OF AM (AMPLITUDE MODULATION) AND PCM (PULSE CODE MODULATION) IN THE CASE OF IMAGE TRANSMISSION

V. Ya. Sorin *In its* 22d All-Union Sci. Session devoted to Radio Day. Sect. on Television 9 Sep. 1966 p 13-17 ref (See N66-38847 24-07) CFSTI: $3.00

A comparison is made of the image transmission procedures with respect to the minimum amount of energy required to transmit a message with a given accuracy. The criterion for evaluating the weight of the distortions defines the probability of the images transmitted along the communication channel with noise independently of what transmission procedure is used: amplitude modulation (AM) or pulse code modulation (PCM) if the signal/noise ratio at the receiver input is $\psi_m < 12$ to 15. The criterion can be used for a comparative evaluation of the relative noise resistance of the AM and PCM procedures for image transmission. The use of PCM for image transmission is expedient only in those cases where on the quality of the image received there are sufficiently high requirements imposed, and the maximum power of transmission is strictly limited. R.N.A.

N66-38851# Joint Publications Research Service, Washington, D. C.

SELECTION OF THE OPTIMAL AMPLITUDE CHARACTERISTICS OF THE IMAGE TRANSMITTER AND RECEIVER FROM THE POINT OF VIEW OF NOTICEABILITY OF NOISE

L. P. Yaroslavskiy *In its* 22d All-Union Sci. Session devoted to Radio Day. Sect. on Television 29 Sep. 1966 p 18-22 refs (See N66-38847 24-07) CFSTI: $3.00

In television, the noticeability of channel noise for a given power decreases if the transmission is accomplished in such a way that the noise is uniformly distributed with respect to the entire range of brightness. In the quasilinear case, where the channel noise is small, this leads to the requirement that the curvature of the amplitude characteristics of transmission are for all levels of brightness inversely proportional to the values of the curve of equal noticeability of the noise. The requirement of equal noticeability of noise is not equivalent to the requirement that it be minimally noticeable. The dependency between the noise parameters on the screen, the image brightness, and the magnitude of the subjective perception of the noise effect need to be known. A case of small noise is considered where the noise distribution in the image is normal and the degree of subjective perception of the noise effect depends only on the image brightness and the standard noise deviation on the screen. The problem of finding the optimal amplitude characteristics of the transmitter is solved as a variation problem. R.N.A.

N66-38852# Joint Publications Research Service, Washington, D. C.

EXPERIMENTAL STANDARD TELEVISION SIGNAL CONVERTOR

S. I. Katayev, V. G. Makovseyev, V. V. Smirnov, E. V. Dymnich, and G. A. Avanesov *In its* 22d All-Union Sci. Session Devoted to Radio Day. Sect. on Television 9 Sep. 1966 p 23-26 (See N66-38847 24-07) CFSTI: $3.00

An apparatus for converting television signals from one standard to another is described. The standard converter's basic assembly consists of an apparatus for sectioning the image which contains an optically joined kinescope pickup tube pair which operate with different scanning standards. The apparatus for sectioning is made in the form of two standard half-bays joined at the top and bottom by two movable frames and form a two-cabinent frame. Above the frame there are a reproduction device and a scan-off chamber joined by a conical tube. The pickup tube of the scan-off chamber introduces distortions which arise in the converted image. Several specific requirements of the pickup tube are discussed. A high quality kinescope is used in the reproduction device to ensure peak brightness. To eliminate distortions of the line beating type, the raw structure of the image is suppressed by a special system of electromagnets located at the tube's throat. A 1:1 picture ratio is used for better use of the kinescope screen area and the target of the pickup tube in the optical transfer section. R.N.A.

N66-38854# Joint Publications Research Service, Washington, D. C.

THE PROBLEM OF SELECTION OF THE FREQUENCY OF THE COLOR SUBCARRIER

A. I. Sharov *In its* 22d All-Union Sci. Session devoted to Radio Day. Sect. on Television 9 Sep. 1966 p 33-37 refs (See N66-38847 24-07) CFSTI: $3.00

A method is proposed for evaluating the noticeability of the interference image obtained as a result of the presence of a color subcarrier in the complete television signal. Author

N66-38855# Joint Publications Research Service, Washington, D. C.

RECEIVING COLOR ON A BLACK AND WHITE KINESCOPE

V. Ya. Chuyev *In its* 22d All-Union Sci. Session Devoted to Radio Day. Sect. on Television 9 Sep. 1966 p 38-42 refs (See N66-38847 24-07) CFSTI: $3.00

A system is described for obtaining color on a black and white kinescope and consists of multivibrators which operate in the autonomous and delay condition. The frequency of pulses of the first multivibrator vary from 4 to 60 cycles. The rear front of this pulse is initiated by the next multivibrator operating under delay conditions. The rectilinear pulse from the third multivibrator together with the image is applied to the switching system made of a diode. The following pulses of the image pass to the kinescope modulator. In place of the image, the voltage from the ZG-10 is sent which modulates the frame scanning of the kinescope. By feeding the ZG-10 oscillator frequency to the video amplifier input, the beam is blocked at determinant points in time. The low frequency positive pulses from a multivibrator reach the kinescope modulator. If the image from the ZG-10 arrives after the illuminating pulse, the light bands on the subsequent dark field are blue. If before the image is shown, a dark field appears on the screen followed by a light field, the image on the background of the light field is green. Red appears if the image is against a light background followed by a dark field. R.N.A.

N66-38858# Joint Publications Research Service, Washington, D. C.

THE RANGE OF COLORS AND THE COLOR EFFECT ON A BLACK AND WHITE KINESCOPE

V. Ya. Chuyev *In its* 22d All-Union Sci. Session devoted to Radio Day. Sect. on Television 9 Sep. 1966 p 43-47 refs (See N66-38847 24-07) CFSTI: $3.00

The range of colors which are reproducable in the subjective coloring of an image on a black and white kinescope is shown to be related to the spectral distribution of the emission of the illuminated surface on which the color effect is reproduced. The calculation of the colors may determine the visual region of colors if the spectrum of luminescence of the surface is presented in the form of three hypothetically active sources: blue, red, and

green which are chosen with the three basic curves for excitation of the eye of man. Such a representation corresponds to the analytical operation of the eye. The results of the calculations coincide with experimental data obtained using a group of observers. R.N.A.

N66-38857# Joint Publications Research Service, Washington, D. C.

THE FINE STRUCTURE OF THE ENERGY SPECTRUM OF A TELEVISION SIGNAL

N. K. Milenin *In its* 22d All-Union Sci. Session devoted to Radio Day. Sect. on Television 9 Sep. 1966 p 48-52 refs (See N66-38847 24-07) CFSTI: $3.00

The distribution of the spectral power density near the scanning harmonics of a television signal are needed to solve many problems, in particular, when separating the useful signal from the noise during transmission of additional information between the scanning harmonics, for linear encoding, etc. However, calculations for certain special types of images (oblique lines) indicate that the concentration of the spectral density near the scanning harmonics decreases with respect to the increase in their number. An investigation is made of the special features of the fine structure of the television signal's energy spectrum assuming that all nodes of the system are linear. R.N.A.

N66-38858# Joint Publications Research Service, Washington, D. C.

CALCULATION OF THE NUMBER OF DEGREES OF BRIGHTNESS REPRODUCIBLE BY THE SYSTEM FOR TRANSMISSION OF AN IMAGE WITH A GIVEN VALIDITY CRITERION

G. A. Nozdrunkov *In its* 22d All-Union Sci. Session devoted to Radio Day. Sect. on Television 9 Sep. 1966 p 53-59 refs (See N66-38847 24-07) CFSTI: $3.00

In order to evaluate image quality and to determine the given quality or probability of image recognition of reproduction systems, an attempt is made to calculate the information capacity of these systems taking into account the properties of the observer, i.e., for a given validity criterion. An expression is given for calculating the number of various brightness shadings on the element of the image depending on its dimensions and taking into consideration the properties of visual perception. R.N.A.

N66-38859# Joint Publications Research Service, Washington, D. C.

LINE SCANNING USING THYRISTORS

V. F. Mosina and M. N. Shuvalova *In its* 22d All-Union Sci. Session devoted to Radio Day. Sect. on Television 9 Sep. 1966 p 60-66 refs (See N66-38847 24-07) CFSTI: $3.00

Silicon control rectifiers or thyristors can be used to lower power losses in the output cascade of the line scanner of television tube receivers. The characteristics and design of these thyristors are described and the results of an experimental investigation of the system are discussed. R.N.A.

N66-38981# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

AUTOMATION Selected Articles

4 Apr. 1966 38 p refs Transl. into ENGLISH from Tzu Tung Hua (Chinese People's Republic), v. 3, no. 3, 1960 p 81-94 (FTD-TT-65-1062; TT-66-61943; AD-636655) CFSTI: HC $2.00/MF $0.50

CONTENTS:

1. PROSPECTS OF REMOTE CONROL PROBLEMS C.-s. Wang p 1-15 (See N66-38982 24-07)

2. SOME POSSIBLE APPLICATIONS OF INFORMATION THEORY TO RADIO TELEMETRY H.-y. Chang p 16-34 refs (See N66-38983 24-07)

N66-38982# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PROSPECTS OF REMOTE CONTROL PROBLEMS

Chuan-San Wang *In its* Automation 4 Apr. 1966 p 1-15 (See N66-38981 24-07) CFSTI: HC $2.00/MF $0.50

Problems dealing with remote control research, theory, and equipment are enumerated. Remote control research includes problems concerning conversion, transmission, and treatment of information in the automation system, regardless of whether the transmission is short- or long-distance. With regard to remote control application, problems of technology, economics, quality, and the local energy source are considered. Theoretical aspects of remote control equipment involve high reliability and speed in signal transmission and signal noise. Investigations of equipment reveal problems of remote measurement without contact point, design of all-powerful combination of remote control equipment, and special communication channels. S.P.

N66-38983# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SOME POSSIBLE APPLICATIONS OF INFORMATION THEORY TO RADIO TELEMETRY

Han-Yin Chang *In its* Automation 4 Apr. 1966 p 16-34 refs (See N66-38981 24-07) CFSTI: HC $2.00/MF $0.50

Improvement of signal transmission efficiency and noise immunity in telemetering systems is discussed with regard to the information theory. Various methods for efficient data transmission are considered in selecting the most economical method—the narrowest frequency bandwidth, shortest time, smallest power required to transmit the largest amount of data. Application of frequency-division and time-division methods of signal division is discussed. The problem of signal-to-noise ratio is examined, and means of reducing noise are proposed. S.P.

N66-38985# Weapons Research Establishment, Salisbury (Australia).

THE SECOND GENERATION OF TELEMETRY AERIALS AT THE WOOMERA RANGE

R. E. Henderson May 1966 58 p refs (WRE-TN-ISD-71) CFSTI: HC $3.00/MF $0.75

Improved autofollowing and slaved aerial systems for the reception of telemetry signals at the Woomera Rocket Range are described. Details of the improvements introduced and the results obtained are given. Author

N66-39055# Joint Publications Research Service, Washington, D. C.

TWENTY-SECOND ALL-UNION SCIENTIFIC SESSION DEVOTED TO RADIO DAY. SECTION ON WIRE COMMUNICATIONS

9 Sep. 1966 74 p refs Transl. into ENGLISH of the Publ. "XXII Vsesoyuznaya Nauchnaya Sessiya, Posvyashchennaya Dnyu Radio: Sektsiya Provodnoy Svyazi" Moscow, 1966 p 1-57 (VPRS-37515; TT-66-33943) CFSTI: $3.00

CONTENTS:

1. SCIENTIFIC PROBLEMS IN THE CONSTRUCTION OF COMMUNICATION NETWORKS V. N. Roginskiy p 1-7 refs (See N66-39056 24-07)

2. PROBLEMS IN THE CONSTRUCTION OF A UNIT MULTIPLEXING-COMMUTATION SYSTEM A. A. Arkhangel'skaya, V. A. Yershov, and V. N. Roginskiy p 8-12 refs (See N66-39057 24-07)

3. SPECIAL FEATURES OF DEVELOPMENT OF THE TECHNIQUES AND EQUIPMENT FOR CONSTRUCTION OF SWITCHING STATIONS R. K. Kvrivishvili and A. D. Kherkevich p 13-18 refs (See N66-39058 24-07)

4. SOME RESULTS FROM THE ANALYSIS OF TRAFFIC DISTRIBUTION IN THE MOSCOW MUNICIPAL TELEPHONE NETWORK O. I. Pankratova and A. P. Pshenichnikov p 19-24 refs (See N66-39059 24-07)

5. THE THEORY OF COMMUNICATIONS SWITCHING STATIONS V. I. Neyman p 25–31 refs (See N66-39060 24-07)

6. THE INFORMATION DATA SEARCH IN AUTOMATION OF THE CALCULATION PROCESSES WITH A SUBSCRIBER FOR LONG DISTANCE CONVERSATIONS V. V. Bunkina p 32-35 (See N66-39061 24-07)

7. NORM INDICES FOR THE USE OF LONG-DISTANCE TELEPHONE CHANNELS M. A. Gorelik p 36–41 (See N66-39062 24-07)

8. AN ASSEMBLY OF COMMUTATION DEVICES MADE OF TUNNEL DIODES AND TRANSISTORS FOR EATS (ELECTRONIC AUTOMATIC TELEPHONE STATIONS) WITH PCM (PULSE-CODE MODULATION) A. P. Ostroverkh p 42–47 refs (See N66-39063 24-07)

9. THE TRANSMISSION OF VOCODER SIGNALS ALONG LOW-CAPACITY DUAL CHANNELS V. I. Kulya p 48–54 refs (See N66-39064 24-07)

10. PROBABILITY RELATIONSHIPS BETWEEN THE TIME AND FREQUENCY CHARACTERISTICS OF COMMUNICATION CHANNELS E. A. Sukachev p 55–59 refs (See N66-39065 24-07)

N66-39056# Joint Publications Research Service, Washington, D. C.

SCIENTIFIC PROBLEMS IN THE CONSTRUCTION OF COMMUNICATION NETWORKS

V. N. Roginskiy *In its* 22d All-Union Sci. Session Devoted to Radio Day. Sect. on Wire Commun. 9 Sep. 1966 p 1–7 refs (See N66-39055 24-07) CFSTI: $3.00

A general discussion is presented of the nature, optimal construction for, and elements of a communications network; and a modern network is regarded as a complex cybernetics system with a multitude of components to perform many different tasks. Economic aspects of such networks are considered, and it is noted that the value of information from the viewpoint of national economy lies in the time and way it is presented. Four different types of structures in networks are distinguished as "each with each", nodal, grid, and with common multipole channels; and most networks contain sections with each type. For optimal construction of a network, it is necessary to know all of the component locations, the flow pattern, the required power, and various cost factors. Reliability in construction is discussed and the complexity of optimal construction is stressed. The importance of commutation and control equipment is mentioned. M.W.R.

N66-39057# Joint Publications Research Service, Washington, D. C.

PROBLEMS IN THE CONSTRUCTION OF A UNIT MULTIPLEXING-COMMUTATION SYSTEM

A. A. Arkhangel'skaya, V. A. Yershov, an V. N. Roginskiy *In its* 22d All-Union Sci. Session Devoted to Radio Day. Sect. on Wire Commun. 9 Sep. 1966 p 8–12 refs (See N66-39055 24-07) CFSTI: $3.00

Examples are given to illustrate the principle of constructing a combined multiplexing-commutation system, which realizes commutation with respect to space and other coordinates. Details are included for a multicrossbar commutator, which is equivalent to a spatial commutator and may be used as the individual functional blocks in multicascade commutation systems. Combining the multiplexing and commutating systems into one unit reduces the total amount of equipment needed as well as the cost. M.W.R.

N66-39058# Joint Publications Research Service, Washington, D. C.

SPECIAL FEATURES OF DEVELOPMENT OF THE TECHNIQUES AND EQUIPMENT FOR CONSTRUCTION OF SWITCHING STATIONS

R. K. Kvirishvili and A. D. Kharkevich *In its* 22d All-Union Sci. Session Devoted to Radio Day. Sect. on Wire Commun. 9 Sep. 1966 p 13–18 refs (See N66-39055 24-07) CFSTI: $3.00

An analysis is made of the components of various commutation systems developed in the United States and the U.S.S.R. which employ quasi-electronic or electronic switching devices, and mention is made of some of the techniques and equipment necessary for network construction. The examples deal with telephone communications and information transmission; and network capabilities, control equipment, and switching devices. M.W.R.

N66-39059# Joint Publications Research Service, Washington, D. C.

SOME RESULTS FROM THE ANALYSIS OF TRAFFIC DISTRIBUTION IN THE MOSCOW MUNICIPAL TELEPHONE NETWORK

O. I. Pankratova and A. P. Pshenichnikov *In its* 22d All-Union Sci. Session Devoted to Radio Day. Sect. on Wire Commun. 9 Sep. 1966 p 19–24 refs (See N66-39055 24-07) CFSTI: $3.00

Trunk flow and intercenter flow patterns are analyzed in terms of average number of daily calls made through the municipal telephone network in Moscow. A gravity constant is estimated on the basis of various daily averages, and the obtained coefficient is referred to as a normalized gravity constant. This information is then used to determine traffic patterns and, eventually, to improve the operation of the network. M.W.R.

N66-39060# Joint Publications Research Service, Washington, D. C.

THE THEORY OF COMMUNICATIONS SWITCHING STATIONS

V. I. Neyman *In its* 22d All-Union Sci. Session Devoted to Radio Day. Sect. on Wire Commun. 9 Sep. 1966 p 25–31 refs (See N66-39055 24-07) CFSTI: $3.00

The mathematical methods of combinatory analysis, probability theory, and variational calculus are discussed in terms of applications to the theoretical aspects of communications switching stations. The combinatory method as applied to the theory of junction points is considered a useful means during the first stage of calculating and constructing communication nodes, while probability theory is used at a later stage. Variation problems in communication node theory are used in the final stage in order to develop optimal systems. M.W.R.

N66-39061# Joint Publications Research Service, Washington, D. C.

THE INFORMATION DATA SEARCH IN AUTOMATION OF THE CALCULATION PROCESSES WITH A SUBSCRIBER FOR LONG DISTANCE CONVERSATIONS

V. V. Bunkina *In its* 22d All-Union Sci. Session Devoted to Radio Day. Sect. on Wire Commun. 9 Sep. 1966 p 32-35 (See N66-39055 24-07) CFSTI: $3.00

An automatic processing method involving various card files is proposed to decrease the time spent in handling long-distance telephone bills. Employing card files designated as nodal, index, transition, enterprise, surname, and street name; the proposed method reduces the required volume of both the external and operative memory of the computer used, as well as the time devoted to search because a multistage search technique is used. The method and card files are discussed briefly, and are considered applicable for developing an automated reference service in Moscow. M.W.R.

N66-39062# Joint Publications Research Service, Washington, D. C.

NORM INDICES FOR THE USE OF LONG-DISTANCE TELEPHONE CHANNELS

M. A. Gorelik *In its* 22d All-Union Sci. Session Devoted to Radio Day. Sect. on Wire Commun. 9 Sep. 1966 p 36–41 (See N66-39055 24-07) CFSTI: $3.00

Plans for increasing the use of long distance telephone calls are discussed in terms of establishing norm indices which will give the best service, increase the productivity of labor, and decrease operating costs. It is noted that present long distance networks use a request system of operation and a predominantly manual procedure for establishing connections; and some data are given which indicate the average yearly use of existing channels. M.W.R.

N66-39063# Joint Publications Research Service, Washington, D. C.

AN ASSEMBLY OF COMMUTATION DEVICES MADE OF TUNNEL DIODES AND TRANSISTORS FOR EATS (ELECTRONIC AUTOMATIC TELEPHONE STATIONS) WITH PCM (PULSE-CODE MODULATION)

A. P. Ostroverkh *In its* 22d All-Union Sci. Session Devoted to Radio Day. Sect. on Wire Commun. 9 Sep. 1966 p 42–47 refs (See N66-39055 24-07) CFSTI: $3.00

Logical and trigger systems are investigated which have time parameters that satisfy the commutation devices for automatic telephone stations using pulse code modulation. Diode transistor logical circuits with tunnel diodes are employed which permit the realization of high speed logical system on existing modular diode equipment by the addition of inverters. Trigger and logical circuits are illustrated, and the laws of distribution of the output parameters of the system are graphed. M.W.R.

N66-39064# Joint Publications Research Service, Washington, D. C.

THE TRANSMISSION OF VOCODER SIGNALS ALONG LOW-CAPACITY DUAL CHANNELS

V. I. Kulya *In its* 22d All-union Sci. Session Devoted to Radio Day. Sect. on Wire Commun. 9 Sep. 1966 p 48–54 refs (See N66-39055 24-07) CFSTI: $3.00

A laboratory model of a transmission assembly for vocoder systems has been developed for use on a discrete channel with a capacity of 1200 bits/sec on the basis of investigation of low capacity dual channels. Approximately 500 transistors were used in the construction of the voice transmission assembly. The experimental procedure of converting a voice signal by using a harmonic vocoder analyzer, and the instantaneous voice spectrum in the 300 to 3400 cycle range was analyzed using 13 band filters with linear detectors. The encoded signals were converted into analog form, and then subjected to nonlinear conversion using an expander with exponential characteristics. As a result of the large damping and the matrix circuit of the analyzer the range of voltages of the signal parameters was up to 0.5 volts. The analysis-synthesizer channel used for the voice is considered of high quality, according to the present state-of-the-art. M.W.R.

N66-39065# Joint Publications Research Service, Washington, D. C.

PROBABILITY RELATIONSHIPS BETWEEN THE TIME AND FREQUENCY CHARACTERISTICS OF COMMUNICATION CHANNELS

E. A. Sukachev *In its* 22d All-union Sci. Session Devoted to Radio Day. Sect. on Wire Commun. 9 Sep. 1966 p 55–59 refs (See N66-39055 24-07) CFSTI: $3.00

Frequency characteristics of communications channels and their corresponding pulse reactions are considered as random processes to permit the application of probability methods for determining the dependency between the average values and those of a specific case. The pulse reaction of a corrected communication channel is presented in the form of a random process with discrete time, and the various reference values are considered as random variables and statistically independent. Approximate methods are used to determine the mathematical expectancy and the dispersion of the function of the random variables; and formulas are given for finding the deviation of these variables from the average when the numerical characteristics of the referenced values of the response are given. Numerical characteristics of the pulse response at the reference points are also determined. M.W.R.

N66-39109# Joint Publications Research Service, Washington, D. C.

INFORMATION VALUE WHEN IT IS IMPOSSIBLE TO OBSERVE DIRECTLY THE EVALUATED VARIABLE

R. L. Stratonovich and B. A. Grishanin *In its* Tech. Cybernetics, No. 3, 1966 28 Sep. 1966 p 1–20 refs (See N66-39108 24-10) CFSTI: $6.00

The information theory, and optimization methods for systems with a limited amount of information are discussed. In cases where the final solution (or value) is derived only on the basis of a limited amount of information about the observed quantity, the synthesis of the optimal circuit is obtained in an analytical form. Investigated are both the case of observation of the evaluated variable itself at the input of the communication channel, and the case of indirect observation where the variable observed is related to the one evaluated randomly. Outlined are: the nonthermodynamic approach for direct observation of the initial quantity, the information value with the nonthermodynamic approach, and thermodynamic direct information values. Different information values for one example are compared. R.U.

N66-39127# Joint Publications Research Service, Washington, D. C.

OPTIMAL DETECTION OF SIGNALS BY A SPATIALLY DISTRIBUTED RECEIVING SYSTEM

V. L. Volkovich and Yu. I. Samoylenko *In its* Tech. Cybernetics, No. 3, 1966 28 Sep. 1966 p 194–205 refs (See N66-39108 24-10) CFSTI: $6.00

The problem is solved of synthesis of an optimal distributed system for detection of signals against a background of a field of random noise. In an example of a two-point system it is shown that the method of time-space selection of the signals permits essential improvement in the quality of detection. Author

N66-39128# Joint Publications Research Service, Washington, D. C.

SYNTHESIS OF DISCRETE SYSTEMS FOR TRANSMISSION OF CONTINUOUS MESSAGES UNDER THE EFFECT OF CHANNEL NOISE

A. I. Velichkin *In its* Tech. Cybernetics, No. 3, 1966 28 Sep. 1966 p 206–219 refs (See N66-39108 24-10) CFSTI: $6.00

The problem of synthesis of the system for transmission of continuous messages with the help of binary signals subject to noise effects is solved as applied to communication and automatic control. The criterion of minimum least square error is used. The methods of the statistical theory of estimates are used to obtain the general solution to the problem of synthesis of systems with feedback and without it. The case of transition of a normal Markov communication is investigated in more detail in a system with a feedback channel. Author

N66-39186# Joint Publications Research Service, Washington, D. C.

THE EFFECT OF OFF-BAND NOISE ON MULTICHANNEL RECEIVERS

F. M. Klement'yev and Yu. P. Sbitnev *In its* Twenty-second All-Union Sci. Session devoted to Radio Day. Sect. on Radio Receivers and Amplifiers 9 Sep. 1966 p 50–54 refs (See N66-39186 24-10) CFSTI: $4.00

A multichannel receiver is investigated which permits the use of the difference of the off-band noise from the useful signal with respect to the carrier frequency and the arrival time. Expressions

are presented for the probability of off-band reception for the multichannel receiver with a coincidence circuit and for the probability of coincidence for stationary and independent flows. A simplification for the probability of coincidence in the case of determinant flows is also found. It is concluded that the multichannel receiver permits a significant lessening of the off-band reception without degrading the conditions of reception of the useful signal. The probability of off-band reception decreases with an increase in the number of receivers. N.E.N.

N66-39197# Joint Publications Research Service, Washington, D. C.

A TRACKING FILTER IN THE RECEPTION OF SIGNALS WITH FREQUENCY MANIPULATION

Ya. G. Rodionov *In its* Twenty-Second All-Union Sci. Session Devoted to Radio Day. Sect. on Radio Receivers and Amplifiers 9 Sep. 1966 p 55–60 refs (See N66-39186 24-10) CFSTI: $4.00

The requirements which must be satisfied by the tracking filter in a receiver are considered. It is concluded that the reception of signals with frequency modulation gives a threshold gain in noise reduction, and that the tracking filter for improved noise to signal ratio is justified. N.E.N.

N66-39198# Joint Publications Research Service, Washington, D. C.

NOISE RESISTANCE OF PHASE RADIOTELEGRAPHY SYSTEMS TAKING INTO ACCOUNT THE FLUCTUATIONS IN THE PHASE OF THE REFERENCE OSCILLATIONS

V. T. Goryainov *In its* Twenty-Second All-Union Sci. Session Devoted to Radio Day. Sect. on Radio Receivers and Amplifiers 9 Sep. 1966 p 61–73 (See N66-39186 24-10) CFSTI: $4.00

Mathematical methods for determining instability and erroneous reception in phase telegraphy (FT) and relative phase telegraphy (OFT) systems are assessed. Two procedures for constructing an optimal receiver are discussed, and it is pointed out that the method selected must be determined after considering the advantages and disadvantages of their technical realization. Results indicated that the noted increase in the probability of erroneous reception of the binary symbols occurs when $n<5$, that is, for a signal-to-noise ratio in the channel for shaping the reference oscillations. It was also found that the instability of the phase of the reference oscillations has the strongest influence on the noise resistance of the FT; the noise resistance of the OFT depends on the instability of the phase of the reference oscillations to a lesser extent. L.E.W.

N66-39199# Joint Publications Research Service, Washington, D. C.

NOISE RESISTANCE OF PHASE TELEGRAPHY IN THE PRESENCE OF FADING AND NONFADING INTERMEDIATE NOISE JOINTLY WITH NOISE IN A CHANNEL WITH FADING

I. N. Kychkin *In its* Twenty-Second All-Union Sci. Session Devoted to Radio Day. Sect. on Radio Receivers and Amplifiers 9 Sep. 1966 p 74–79 refs (See N66-39186 24-10) CFSTI: $4.00

A method is considered for determining the error probability of reception of phase telegraphy (FT) and relative phase telegraphy (OFT) signals under the simultaneous effect of sinusoidal and other noise. The case is considered in which both the signal and the concentrated noise fade according to generalized Reley law, and it is pointed out that the presence of a large regular component of the signal ensures high noise resistance in reception of FT and OFT signals. The case in which the concentrated noise fades according to a Reley law is considered next, and it is stated that the effect of the sinusoidal noise that fades according to Reley law is equivalent to the effect of the noise. Finally, the case in which the signal just as the noise fades according to Reley law is examined. The effectiveness of the dual reception for these cases is then assessed. L.E.W.

N66-39200# Joint Publications Research Service, Washington, D. C.

THE EXISTENCE OF REGIONS OF LOWERED NOISE PROTECTION IN FT AND OFT RECEIVERS UNDER THE EFFECT OF CONCENTRATED NOISE

N. T. Petrovich, I. N. Kychkin, and *P. A.* Gerastovskiy *In its* Twenty-Second All-Union Sci. Session Devoted to Radio Day. Sect. on Radio Receivers and Amplifiers 9 Sep. 1966 p 80–85 refs (See N66-39186 24-10) CFSTI: $4.00

A procedure for determining the noise resistance of phase telegraphy (FT) by phase comparison was extended for the case in which there is detuning of the noise with respect to the signal. The experimental curve of the dependency of the threshold of correct operation on the detuning is presented in a figure, which demonstrates that the threshold of correct operation corresponds to fragmentation of the pulse. A decrease is noted in the thresholds when detuning the signal with respect to the resonance frequency of the kinematic filters. The minimum threshold ratio was determined at the input of the receiver for stated conditions of disturbance of operation of the receiver. It was found that the sinusoidal noise with a power equal to 1/4 the noise of the signal and falling in the range of the side frequencies causes disturbance of reception. The sinusoidal noise that falls in the region of the carrier frequency will disturb reception if its power is 1/2 the signal power. Figures illustrate proposed circuits that have a higher noise resistance to the effect of sinusoidal noise. L.E.W.

N66-39297# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

POSSIBILITIES OF APPLYING INFORMATION THEORY TO TELEMETRY

Tadeusz Balchan *In its* Polytech. Inst., Sci. Papers, Automation 9 May 1966 p 1–20 refs (See N66-39296 24-10) CFSTI: HC $2.00/MF $0.50

The paper defines the fundamental concepts of information theory for telemetric systems. The fundamental problems of statistical methods used in telemetering are discussed. A number of quantities making it possible to formulate information criteria for estimating the quality of telemetering is defined. Author

N66-39299*# Mississippi State Univ., State College. Dept. of Electrical Engineering.

A STUDY OF 2 GHZ REGION ELECTROMAGNETIC PROPAGATION OVER SELECTED TERRAINS Progress Report, 28 Feb.–1 Sep. 1966

James O. Hebert, Jr. 28 Sep. 1966 12 p

(Grant NGR-25-001-007)

(NASA-CR-78743) CFSTI: HC $1.00/MF $0.50 CSCL 09F

Ten different paths in the 2 GHz frequency region of the Gulf-South area of the United States were monitored to obtain signal propagation reliability data. Signal fading distributions were plotted for two week periods and for a six-month total for each path, and equations were derived from these experimentally obtained signal level distributions for calculating the required fead margins for a given propagation reliability as a function of path length and geographical location. A digital computer program was written in Fortran language that allowed calculation of the required fade margin when the desired propagation reliability, path length, and geographical location were stated. Simultaneous recordings of the AGC signals for three paths with cross correlations were also reported. G.G.

N66-39302# Naval Research Lab., Washington, D. C.

HIGHLY DIRECTIVE ANTENNAS USED IN NRL'S RADIO ASTRONOMY PROGRAM. PART III: THE EIGHTY-FIVE FOOT RADIO TELESCOPE

E. F. Mc Clain *In its* Rept. of NRL Progr. Aug. 1966 p 5–10 refs (See N66-39300 24-34)

An 85-foot diameter radio telescope has been built at NRL's Maryland Point Observatory. It was designed to be useable to wavelengths as short as 1 centimeter, have a pointing accuracy of about ±0.5 minutes of arc, and have a gain that is independent of position within 45° of the zenith. From mechanical and optical tests that have been conducted, it appears that the objectives have been achieved. Aperture efficiency of the instrument, derived from measurements of Venus and Jupiter, is 58 percent at 3.15 centimeters, 49 percent at 2.07 centimeters and 41 percent at 1.55 centimeters. Results of tracking tests indicate that the instrument points within the ±0.5 minute of arc specification. From tests thus far conducted it appears that this telescope is one of the most sensitive in the world in the wavelength range from 1 to 2 centimeters. Author

N66-39321# Royal Danish Geodetic Inst., Copenhagen.
A FREQUENCY MEASURING SYSTEM
Knu Poder and Ole Bedsted *In* Tellurometer (Pty.), Ltd. Proc. of the 1962 Tellurometer Symp. 1962] 9 p refs (See N66-39306 24-14) CFSTI: HC $6.00/MF $1.75

This paper deals with a frequency measuring system for field use. The equipment consists of a 100 kc/s crystal oscillator, two harmonic generators for 1 Mc/s and 10 Mc/s, a 1 kc/s and a 1 kc/s divider and a mixer, forming the secondary frequency standard. An 8-tube double conversion superheterodyne receiver fixed-tuned for 10 Mc/s was constructed for the reception of WWV and MSF. Finally a direct-indicating transistorized low-frequency meter was developed for measuring the difference frequencies delivered by the receiver. In order to determine the sign of the difference frequency and to avoid using too low difference frequencies, the secondary frequency standard is tuned 80 c/s above or below the 10 Mc/s standard frequency received. This is checked by means of the low-frequency meter. The mixer uses frequencies from the harmonic generators and the dividers to convert the Tellurometer modulation frequencies to frequencies in the neighbourhood of 10 Mc/s to be within the bandwidth of the receiver. Author

N66-39471# Technical Univ. of Denmark, Lyngby. Lab. of Electromagnetic Theory.
REFLECTOR ARRAYS Annual Summary Report, 1 Apr. 1965–30 Apr. 1966
Erik Drago Nielsen May 1966 24 p refs
(Contract AF 61(052)-794)
(S-127; R-51; AFCRL-66-561; AD-637555) CFSTI: HC $1.00/MF $0.50

A scheme for a theoretical investigation of a square Van Atta reflector consisting of half-wave dipoles with a conducting plate parallel to the plane of the dipoles is given. The reradiation pattern of the reflector has been examined both analytically and numerically and the results have been compared with experimental results obtained by others. The influence of the presence of the plate and of changing the values of the parameters has been investigated. A theoretical examination concerning the dependence of the reradiation pattern on the parameters of a four-element linear Van Atta reflector has been performed and a numerical optimization of the reradiation pattern has been carried out. The possibility of using the technique of dynamic programming to determine the dimensions of antenna arrays with prescribed properties, especially Van Atta reflectors, has been examined. Author (TAB)

N66-39482# Illinois Univ., Urbana. Coordinated Science Lab.
CONTROL SYSTEM SYNTHESIS TO MINIMIZE MULTIPARAMETER SENSITIVITY
Richard Lawrence Gonzales Aug. 1966 83 p refs
(Contract DA-28-043-AMC-00073(E))
(R-312; AD-637469) CFSTI: HC $3.00/MF $0.75

A new multiparameter sensitivity index for control systems is introduced. This measure of the deterioration in the system performance is based either on the integral square error or the mean square error in the system response due to parameter variations. A first order approximation to the change in the system transmission is used to simplify these functions. The index is extended to include situations when the varying parameters are stochastic. The expected value of the index with respect to the parameters is employed under these conditions. Moreover sensitivity analysis techniques for worst case conditions are developed to deal with parameter specifications in the form of tolerances. Synthesis procedures are derived which permit the minimization of the control system sensitivity with respect to the parameters. These procedures are investigated in terms of the control system stability and physical realizability. They also are applied to reduce response errors due to noise input signals and parameter variations, which occur simultaneously. The errors involved in the first order approximation to the change in the system transfer function are explored for a specific example. Numerical examples computed on the CDC 1604 computer are given to illustrate the analysis and synthesis procedures. Author (TAB)

N66-39483# Ballistic Research Labs., Aberdeen Proving Ground, Md.
DEVELOPMENT OF GUN PROBE PAYLOADS AND A 1750 MC/S TELEMETRY SYSTEM
James W. Evans May 1966 73 p refs
(BRL-MR-1749; AD-637747) CFSTI: HC $3.00/MF $0.75

The feasibility of using a 1750 Mc/s telemetry system, Langmuir probes, and other data sensors in gun launched projectiles used as upper atmosphere probes has been demonstrated by high acceleration testing techniques and actual projectile flights. Instrumentation capable of withstanding launching accelerations of 50,000 G has been produced. Descriptions of the payloads carried by projectiles launched from 5-inch, 7-inch, and 16-inch guns, and evaluations of component performance during flights are presented. Future plans call for modular construction, further ruggedization and miniaturization of the payload and the development of a 415 Mc/s ranging receiver. Author (TAB)

N66-39516# Inter-Range Instrumentation Group, White Sands Missile Range, N. Mex.
IRIG RIG STANDARD COORDINATE SYSTEM AND DATA FORMATS FOR ANTENNA PATTERNS IRIG 1966 108 p
(IRIG-111-65; AD-637189) CFSTI: HC $4.00/MF $0.75

The efficient exchange of technical information among groups which normally participate in complex scientific programs is essential; the problem is important, and extremely difficult, especially in the rapidly expanding range and innter-range requirements for testing missiles and space vehicles. One area, for example, concerns information exchange on radiation characteristics of vehicle and land-based antennas. The antenna serves as a critical interface between the airborne system installed and operated by one group and the ground insturmentation system usually operated by another group. In this particular area, the establishment of standards is necessary. Accordingly, this document defines (1) a vehicle-antenna coordinate system and (2) antenna pattern formats recommended for use at the National and Service Ranges. Antenna polarization considerations, a sample analysis of a three-dimensional antenna pattern, and a number of definitions associated with vehicle antenna pattern representation are presented Author (TAB)

N66-39548# Rome Univ. (Italy). Istituto di Elettronica.
PROPAGATION OF WAVES IN SPECIAL MEDIA AND GEOMETRIES Annual Scientific Report No. 1, 1 Jun. 1964–31 Mar. 1966
Giorgio Barzilai and Giorgio Gerosa 1 Apr. 1966 4 p refs
(Contract AF 61(052)-807)
(AFCRL-66-437; AD-637179) CFSTI: HC $1.00/MF $0.50

A modal solution for a cylindrical waveguide of arbitrary cross section filled with longitudinally magnetized ferrite was investigated. The thermodynamic paradox associated with a ferrite loaded rectangular waveguide was discussed. The various structures introduced to resolve the paradox were shown to be, even in the limit case, different structures from the original one leading to the paradox, and therefore do not help in resolving the apparent inconsistency. Some experiments were conducted to explain how in a physical structure the power is actually dissipated. The same above mentioned experimental technique was used to verify the theoretical behavior of some microwave ferrite structures. R.N.A.

N66-39549# Air Force Western Test Range, Vandenberg AFB, Calif.
POWER TRANSFER BETWEEN TWO ANTENNAS WITH SPECIAL REFERENCE TO POLARIZATION
Beuhring W. Pike Dec. 1965 72 p refs
(AFWTR-TR-65-1; AD-637134) CFSTI:HC $3.00/MF $0.75

The literature abounds with examples of a convenient equation (the beacon equation) for calculating the free-space power transfer between two widely spaced radio antennas haveing polarizations that are matched for maximum power transfer. On the other hand, convenient equations for making such calculations where the polarizations are not matched are very scarce. In this paper the well known beacon equation has been combined with a published (but relatively little known) general equation for polarization mismatch loss, so as to yield a complete general equation for calculating the power transfer between two widely spaced antennas in free-space. For convenience, the portion of the general power transfer equation that accounts for polarization mismatch loss has been reduced to yield a special equation for each of the five limiting cases. Also given are discussions of polarization problems and solutions in radio and radar, and a discussion of antenna radiation field representation methods and their use in calculating the power transfer between two antennas Author (TAB)

N66-39584# Radio Corp. of America, Patrick AFB, Fla.
EVALUATION OF THE PHASE-LOCKED INTERFEROMETRIC TRACKING SYSTEM (PHINTS)
John A. Cribbs, Jr. Patrick AFB, Fla., AF Eastern Test Range, Jul. 1966 64 p
(Contract AF 08(606)-7500)
(ETR-TR-66-6; AD-637273) CFSTI: HC $3.00/MF $0.75

The Phase-Locked Interferometric Tracking System (PHINTS) is a passive HF-VHF radio interferometer which employs baselines five wavelengths long. Its use as a pulse radar acquisition aid was evaluated by a series of satellite tracking tests conducted between 14 April 1966 and 11 May 1966. During these tests, the PHINTS system tracked the 126 MHz transmitters on board the Pegasus satellites and provided asimuth and elevation data to the Synchro inputs of an AN/FPQ-6 radar. The radar acquired track of the satellite by slaving to PHINTS designate data and when necessary scanning about the PHINTS data. An analog off-axis corrector modification which after detection of a target return, would compensate for low frequency errors in the PHINTS data was added to the radar to increase the probability of acquisition. The radar used in the test program had previously been modified so that designation of target range was not required. Best acquisition results were obtained using either no scan or a 3 deggree circle scan. Comparison of the PHINTS and radar data indicate that the PHINTS data are accurate to plus or minus 1.5 degrees at elevation angles greater than 20 degree. The number of PHINTS-directed acquisitions and their distribution indicate that an AN/FPQ-6 radar equipped with an analog off-axis corrector can use PHINTS data to reliably acquire track of targets at elevation angles between 20 and 70 degrees. TAB

N66-39635# Washington Univ., Seattle. Dept. of Electrical Engineering.
CONICAL SURFACE STUDIES Final Report, 15 Mar. 1963-14 Mar. 1966
Akira Ishimaru Apr. 1966 25 p refs /ts Tech. Rept.-106
(Contract AF 19(628)-2763)
(AFCRL-66-517; AD-637762) CFSTI: HC $1.00/MF $0.50

The report gives a summary of all the work completed. The work covers a broad spectrum, including antennas, antenna arrays, pattern systhesis, periodic structures, coupled mode theory, log periodic antennas, discontinuities, partial coherence and dispersive media. The emphasis for this research was directed at understanding the physical phenomena, the mathematical techniques and establishing satisfactory theories in each area Author (TAB)

N66-39662# Tufts Univ., Medford, Mass. Dept. of Mechanical Engineering.
A STUDY OF ACOUSTICAL MULTIPATH SYSTEMS. SECTION III: APPARATUS AND DEVICES
Harald Robinson and William van Lennep 1 Jun. 1966 22 p
(Contract Nonr-494(00))
(AD-637249) CFSTI: HC $1.00/MF $0.50

The investigation of the effects of multiple paths on acoustic signals led to the design and development of a number of devices and associated apparatus. For use in this investigation, commercially available headphones were found to have an unsatisfactory frequency response between 20 Hz and 20 KHz. A capacitor, semi-insertion earphone (WG) was designed with a substantially flat response in this frequency range. A d.c. bias supply and binaural preamplifier (BLB-1) was obtained and modified for use with the capacitor earphone. There were no commercially available, acoustic signal pickup systems with the delay paths and frequency response characteristics of the human pinna. An artificial, binaural pinna pickup system was designed to provide a source signal for the subjective speech recognition tests Author (TAB)

N66-39663# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SYNCHRONOUS OBSERVATIONS OF ECHO 1 IN 1963
D. Ye. Shchegolev 23 Feb. 1966 5 p ref Transl. into ENGLISH from Astron. Sov. Byul. Stantsiy Optich. Nablyudeniya Iskusstv. Sputnikov Zemli (USSR), no. 36, 1965 p 21-22
(FTD-TT-65-1736; TT-66-62097; AD-637419) CFSTI: HC $1.00/MF $0.50

Photographic observations of the artificial earth satellite were made from the tracking stations of the German Democratic Republic, Poland, Rumania, the Soviet Union and Czechoslovakia. Information from all stations allowed the selection of synchronous groups from the number of obtained negatives. TAB

N66-39668# Radiation, Inc., Melbourne, Fla.
TV DATA COMPACTION STUDY Final Report
Feb. 1966 84 p
(Contract DA-28-043-AMC-01677(S))
(AD-637694) CFSTI: HC $3.00/MF $0.75

The study was made to provide data about the characteristics of meteorological weather pictures that would allow efficient application of data compaction processes to the transmission and reproduction of these picturas. The equipment utilized for this study were the government-furnished Automatic Picture Transmission (APT) Ground Station and the Radiation Incorporated Data Management Analyzer (DMA). The APT system provided a means of scanning pictures, generating video signals, transmitting these signals, and then reconstructing a final output picture from this data. The Data Management Analyzer was used to process the data between the transmitter and receiver to simulate an actual data compression transmission system. The flexibility of the DMA enabled the selection of a number of different processing modes and provided all required data to quickly evaluate the effects of

these different processes. The goal of the study was to obtain a minimum reduction ratio of 5 to 1 with acceptable picture quality. This goal was accomplished. (Author) TAB

N66-39699*# Brown Engineering Co., Inc., Huntsville, Ala. Research Labs.
COMPARISON OF SPECTRA OF SINGLE SIDEBAND AND PHASE MODULATED SIGNALS
R. R. Parker, E. E. Klingman, and S. Wolin Feb. 1964 53 p ref
(Contract NAS8-11526)
(NASA-CR-78870; A-13-R-91; R-91) CFSTI: HC $3.00/MF $0.50 CSCL 09D

Mathematical expressions for a phase modulated signal and single sideband modulated signal are derived and compared. The effects of nonlinearities in the transponder transmitters are noted, and equations are derived to show the cross-modulation products that are generated by small nonlinearities in the airborne tracking receiver. The conclusion is reached that the nonlinearities in the transponder transmitter and in the airborne receiver cause a single-sideband signal to have sidebands that occupy a major portion of the frequency band occupied by the sidebands of a phase modulated signal. Author

N66-39713*# University of Southern Calif., Los Angeles. Dept. of Engineering.
SIGNAL DESIGN FOR SPACE COMMUNICATION CHANNELS, PART I
Charles L. Weber Feb. 1965 168 p refs
(Grants NsG-237; AF-AFOSR-496-65)
(NASA-CR-78972; USCEE-129) CFSTI: HC $5.00/MF $1.00 CSCL 17B

An approach is discussed for designing optimal signals when they are constrained to a specified average power and a finite time duration. Finite bandwidth is precisely defined in relation to its effect on optimal signal design. The design criterion of probability of error is adopted because of its inherent physical significance based on the law of large numbers. The optimization is then viewed as minimizing the probability of error for a given allowable signal power. The optimization used is based on minimizing the probability of error for a given allowable signal power, which places the optimal signal design problem in the context of information theory or error-correcting codes. It is pointed out that although the information-theoretic notions are not necessary, they are useful to indicate what the connections are. M.G.J.

N66-39743# Conductron Corp., Ann Arbor, Mich.
INVESTIGATION OF ELECTROMAGNETIC FIELDS IN THE FOCAL REGIONS OF A PARABOLOID RECEIVING OFF-AXIS Final Report, 13 Dec. 1965–15 Jul. 1966
Irvin W. Kay and Morton Goldberg 24 Jun. 1966 90 p refs
(Contract AF 19(628)-5812)
(D-5220-448-P410; AFCRL-66-461; AD-637682) CFSTI: HC $3.00/MF $0.75

The problem of evaluating numerically the Debye-Picht Luneberg electromagnetic diffraction integrals in the short wavelength limit was investigated, and the method of stationary phase for evaluating these integrals was generalized for application to caustic regions. A test problem, involving the diffraction of a plane wave by a perfectly conducting paraboloidal reflector, was considered in this investigation. Results of sample calculations illustrating the techniques evolved are discussed. Author (TAB)

N66-39745# Radiation, Inc., Melbourne, Fla.
AN INVESTIGATION OF THE TRANSMISSION OF DIGITAL SIGNALS THROUGH A DISPERSIVE CHAFF CHANNEL Final Report No. 2, 1 Jun. 1965–1 May 1966
L. H. Bauer and R. M. Langelier Ft. Monmouth, N. J., Army Electron. Command, Jul. 1966 218 p refs
(Contract DA-28-043-AMC-00202(E))
(ECOM-00202-2; AD-637673) CFSTI: HC $6.00/MF $1.25

The purpose of the Abstract Task III effort was to quantitatively determine the information capacity (and its behavior) of a cloud of chaff dipoles. The effort was directed to theoretical and experimental investigations of binary FSK transmission through a dispersive chaff scatter channel. The experimental work was performed at a frequency of 4650 MHz. Good agreement was obtained between experimental data and theoretical results. Probability of error for a modulating signal of 600 KBPS varied from 0.25 to 0.00015. Measured coherent bandwidth varied from 0.27 to 2 MHz. The median value of measured signal to noise ratio was 23 db. The median value of fading bandwidth was 8 Hz. It was concluded that dispersion of the chaff dipoles adversely affected both signal to noise ratio and probability of error. The linear, time variant, random parameter filter modeled the chaff scatter channel for binary FSK operation. It was determined that the chaff scatter channel met the conditions of a time flat-frequency selective channel; i.e., the predominate effect of the cloud on the received waveform was intersymbol influence. (Author) TAB

N66-39769# Naval Ordnance Lab., Corona, Calif.
AN EASILY CONSTRUCTED VLF TRANSMITTING ANTENNA
Elwin W. Seeley 8 Aug. 1966 21 p refs
(NOLC-669; AD-637580) CFSTI: HC $1.00/MF $0.50

A moderately efficient, low cost, broad-band VLF transmitting antenna that can easily be consstructed over low-conductivity terrain is discussed. The antenna consists of 20 horizontal conductors 12 km in length that are arranged into four dipoles wavelength/2 apart which radiate a 26 degrees steeerable beam. The dipoles are 1 wavelength and are fed off-center to obviate vertical radiation; their radiation patterns and those of the four-dipole array are presented. Dipole input impedances and antenna efficiency at 20 kHz are derived; antenna voltage and current at 1 MW input power are shown to be satisfactory. (Author) TAB

N66-39787# Air Force Cambridge Research Labs., Bedford, Mass.
THE FEASIBILITY OF DETECTING SHOCK WAVES BY PULSE DOPPLER RADAR Interim Scientific Report
Kenneth M. Glover May 1966 33 p refs *Its* Environ. Res. Paper no. 200
(AFCRL-66-378; AD-637705) CFSTI: HC $2.00/MF $0.50

Classical geometric optics estimates of the echo characteristics from both isotropic and directed acoustic shocks are presented together with the detection capability of a typical sensitive pulse Doppler radar (AFCRL Porcupine Doppler) in order to determine the feasibility of detecting large well defined boundaries of refractive index. Both the radar cross-section and the Doppler spectrum of an acoustic shock are sensitive to wind and temperature induced perturbations of the shock surface. For standard deviations in wind and temperature of 0.5 m/sec and 1C, the theoretical values of the maximum radar cross-section and minimum Doppler spectral width of a typical directed shock of 50 meters radius are found to be 0.0008 sq cm and 58 cps respectively. This target cross-section is about 6 dB stronger than the minimum cross-section detectable by the Porcupine radar at a range of only 1.8 kilometers. At this range, the presence of a weak signal may be completely masked by the presence of strong ground clutter signals. Signal processing techniques which improve the mean square to noise ratio and provide sub-clutter visibility are therefore crucial to the success of the experiment. Moreover, the sensitivity of the radar cross-section and the Doppler spectrum to wind and temperature perturbations restricts the experiments to calm conditions. Author (TAB)

N66-39861# Harvard Univ., Cambridge, Mass. Cruft Lab.
THE INTEGRAL EQUATION FOR THE CURRENT IN A THICK TUBULAR ANTENNA
Tai Tsun Wu and Ronold W. P. King May 1966 20 p refs
(Contract Nonr-1866(32))
(TR-502; AD-637990) CFSTI: HC $1.00/MF $0.50

The conventional integral equation for the current in a cylindrical antenna is not correct for a tubular antenna when driven by an emf maintained in a narrow circumferential region along its outside surface. The basic electromagnetic theory of the doubly-connected region represented by such an antenna is reviewed. It is shown that the scalar potential and the normal derivative of the vector potential must be discontinuous across the air cylinder within the tube and that this discontinuity contributes an additional term to the integral equation. This term is negligible for electrically thin antennas but of major importance in determining the current and admittance for antennas that are electrically thick
Author (TAB)

N66-39935*# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
A STUDY OF APOLLO ANTENNA AND SIGNAL PERFORMANCE IN CERTAIN ATMOSPHERES Final Report, 21 Sep. 1965–21 Apr. 1966
21 Apr. 1966 176 p refs
(Contract NAS9-5228)
(NASA-CR-65534; FR66-14-117) CFSTI: HC $3.25/MF $1.00

Reported is a study of the factors affecting the polarization and signal transfer of the Apollo Telecommunications link. The effect of the various factors upon the performance of the Apollo system are considered. A comprehensive literature search was made to determine what information is currently available which is applicable to the Apollo link. Additional analysis and some experimental work is carried out on those problems not covered in the literature. It was found that the principal factors limiting performance of the telecommunications link are: (1) off axis ellipticity of the spacecraft antennas resulting in power transfer loss; (2) multipath propagation at low angles resulting in boresight tracking errors and increased noise which limits the region of track and communication near the horizon; and (3) plasma sheath formation during reentry. Detailed analysis of the first two factors is made and some consideration is given to means of reducing these effects.
Author

N66-39979*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ANALYSIS OF THE CALIBRATION TESTS FOR THE APOLLO VARIAN RUBIDIUM FREQUENCY STANDARDS
C. W. Murray, Jr. May 1966 38 p refs
(NASA-TM-X-55571; X-507-66-247) CFSTI: HC $2.00/MF $0.50
CSCL 09F

Results of calibration tests conducted by the Bureau of Standards on three R-20 Rubidium Frequency Standards are analyzed. The technique of least squares is used to calculate "best fit" zero, first, second, and third degree polynomials which describe as a function of time the variation in relative frequency of each standard from a reference—the United States Frequency Standard. A pooled sample of deviations of the daily readings from the daily averages is compared to a normal distribution having the same mean and standard deviation. This is done for each unit. In addition, the residuals of the "best fit" straight lines for each frequency standard are compared to a normal distribution. The deviations of the daily readings from the daily averages as well as the residuals of the "best fit" straight lines show fairly good agreement with a normal distribution. Using the expressions for the "best fit" straight lines, the drifts in relative frequency over a period of one year are: $-(13.6)10^{-11}$, $+(34.1)10^{-11}$, and $+(1.7)10^{-11}$.
Author

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N66-38909# Československa Akademie Ved, Rez.
STATIC PROGRAMMING OF DATA HANDLING
P. Kovanic *In* IAEA Nucl. Electron. 1966 p 559–574 refs (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

The choice of the algorism of data handling is of primary importance in increasing the effectiveness of using digital computers. The idea of static programming is to split the digital process into two parts. The first part consists in computing the digital operator in the form of a vector. The second part consists in using this vector to obtain the result as the scalar product of the vector-operator and of an input vector. The time necessary for the second part may be a small fraction of the first and for process reiteration only the second part need be repeated with new input vectors. The theoretical basis of this method is the solution of the generalized discrete Zadeh-Ragazzini's problem. On application to computer control of nuclear reactors and power plants, static programming permits a number of digital operators to be kept ready for use in the memory of an on-line computer and the on-line computation to be limited to the scalar products. Time and space smoothing, interpolation or prediction of functions, their derivatives and integrals (the functions being given by series of their numerical values) can be performed in such a way. As another example of static programming, harmonic analysis of frequency response is shown. Digital operators providing given analytical features and the best statistical accuracy of results and requiring minimum of operation time can be useful also as elements of such complicated calculations even where their direct use is not possible.
Author

N66-38910# India. Dept. of Atomic Energy, Bombay.
THE NEED FOR SOPHISTICATION IN MULTIPARAMETER ANALYSIS AND REAL-TIME DATA PROCESSING
P. K. Patwardhan *In* IAEA Nucl. Electron. 1966 p 575–593 refs (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

The use of "wired-program" computers and the concept of system organization using an "on-line" special purpose computer for data taking and closed-loop control has been fully discussed. Advantages of analyser-computer systems for data taking are pointed out. Prerequisites of stored-programme computers for specific applications have been clearly defined. The need for optimization and for maintaining proper logical balance between hardware, software, and multiple time-sharing (real time) for on-line application has been emphasized. Special problems arising in long-distance data communication and remote experimental control are clearly indicated. A picture of the present state of the art and possible trends for future development are presented. Implementation of computer-based conventional and nuclear reactor power plant control and of "in-pile" loop experiments is also explained. In the light of the foregoing discussion the feasibility of establishing a "Nuclear Data Centre" at the Trombay Establishment with a number of Satellite computers carrying out concurrently real-time data processing and control operations and communicating on a micro-wave link with the Central computer is also touched upon.
Author

N66-38911# India. Dept. of Atomic Energy, Bombay.
AN AUTOMATIC DATA-LOGGING SYSTEM FOR METEOROLOGICAL STUDIES IN REACTOR ENVIRONMENTS
C. W. Joshi, N. A. Ingle, and N. B. Jathar *In* IAEA Nucl. Electron. 1966 p 595–603 refs (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

The system is designed to log data from 256 sensors divided into two groups of 128 each. The outputs from the sensors in analog form, varying from 0 to 100 mV can be scanned sequentially. The scanning unit connects sequentially the outputs from the two groups of sensors to two chopper-modulated dc amplifiers. A linear and highly stable A-D converter connected alternately to the chopper-modulated dc amplifiers digitizes the amplified outputs. The digitized data are stored in a ferrite core memory with a capacity

of 256 5-digit words and are handled in the binary-coded decimal form. Each memory location corresponds to a particular input sensor. When sensor Mi is selected by the scanning unit, its digitized output is added to the previously stored data in the Mi^{th} memory location and the result is stored back in the same location. The Mi+1 sensor is next selected. At the end of 10 min the memory locations contain the averages of outputs of all the sensors. This data is punched on a paper tape in the next 2 min. The sensors are scanned again after clearing the memory. The logical operations are controlled with a 100-kc/s crystal controlled time clock. The data are fed to a digital computer for analysis. Author

N66-38926# Wayne State Univ., Detroit, Mich.
PROCEEDINGS OF THE CONFERENCE ON COMPUTER-RELATED SEMANTIC ANALYSIS
1965 161 p refs Conf. held at Las Vegas, Nev., 3–5 Dec. 1965; sponsored by NSF, ONR, and AF
(AD-636508) CFSTI: HC $7.00/MF $1.75

CONTENTS:

1. INTERFACES OF LANGUAGE W. Lehmann (Texas Univ.) 6 p (See N66-38927 24-08)

2. THE OUTLOOK FOR COMPUTATIONAL SEMANTICS Y. Bar-Hillel (Hebrew Univ.) 7 p (See N66-38928 24-08)

3. SOME TASKS FOR SEMANTICS U. Weinreich (Center for Advanced Study in Behavioral Sci.) 6 p ref (See N66-38929 24-08)

4. STRUCTURAL SEMANTICS: THEORY OF SENTENTIAL MEANING E. Charney (MIT) 13 p (See N66-38930 24-08)

5. SEMANTIC ALGORITHMS M. Masterman (Cambridge Language Res. Unit) 49 p refs (See N66-38931 24-08)

6. SOME QUANTITATIVE PROBLEMS IN SEMANTICS AND LEXICOLOGY S. Ullmann (Leeds Univ.) 10 p (See N66-38932 24-08)

7. PROBLEMS IN AUTOMATIC WORD DISAMBIGUATION H. Rubenstein (Harvard Univ.) 10 p refs (See N66-38933 24-08)

8. SOME SEMANTIC RELATIONS IN NATURAL LANGUAGE F. Kiefer (Hungarian Acad. of Sci.) 12 p refs (See N66-38934 24-08)

9. UNDERLYING STRUCTURES IN DISCOURSE T. G. Bever and J. R. Ross (MIT) 6 p refs (See N66-38935 24-08)

10. MULTIDIMENSIONAL SCALING AND SEMANTIC DOMAIN A. K. Romney (Harvard Univ.) 10 p refs (See N66-38936 24-08)

11. SEMANTIC CLASSES AND SEMANTIC MESSAGE FORMS K. S. Jones (Cambridge Language Res. Unit) 10 p refs (See N66-38937 24-08)

12. SEMANTIC SELF-ORGANIZATION E. D. Pendergraft (Texas Univ.) 8 p refs (See N66-38938 24-08)

13. A TAG LANGUAGE FOR SYNTACTIC AND SEMANTIC ANALYSIS W. J. Plath (IBM) 10 p refs (See N66-38939 24-08)

14. AN APPROACH TO THE SEMANTICS OF PREPOSITIONS E. von Glasersfeld (IDAMI) 13 p refs (See N66-38940 24-08)

N66-38927# Texas Univ., Austin.
INTERFACES OF LANGUAGES
Winfred Lehmann *In* Wayne State Univ. Proc. of the Conf. on Computer-Related Semantic Anal. 1965 6 p (See N66-38926 24-08) CFSTI: HC $7.00/MF $1.75

Computer capability of simulating language, the relationship between description of language and programming systems, the role of semantic entities in language, morphophonemic interfaces, and other current semantic theories are briefly outlined. It is stated that the separation of subareas, with subsequent interfacing, of the two distinct descriptions of segments of language has been a successful programmatic and experimental procedure, and various approaches are reviewed. The importance of consistency in terminology is stressed. R.U.

N66-38928# Hebrew Univ., Jerusalem (Israel).
THE OUTLOOK FOR COMPUTATIONAL SEMANTICS
Yehoshua Bar-Hillel *In* Wayne State Univ. Proc. of the Conf. on Computed-Related Semantic Anal. 1965 7 p (See N66-38926 24-08) CFSTI: HC $7.00/MF $1.75

Semantic analysis in computerized information processing is briefly examined. It is considered that computational semantics exhibit hidden ambiguities on occasion better than humans can; the machine offers two meanings from which a choice is to be made. The need for standardization of input meanings is noted, particularly for medical diagnosis, jurisprudential purposes, and scientific uses. The apparent schism between linguistics and logic is mentioned, along with the fact that the meaning connections between the various terms in natural languages cannot be handled by dictionaries alone. The borderline between semantics and syntactics is illustrated by examples. The view is expressed that computers alone cannot yet determine the meaning or meanings of any given natural language text. R.U.

N66-38929# Center for Advanced Study in Behavioral Sciences, Stanford, Calif.
SOME TASKS FOR SEMANTICS
Uriel Weinreich *In* Wayne State Univ. Proc. of the Conf. on Computer-Related Semantic Anal. 1965 6 p ref (See N66-38926 24-08) CFSTI: HC $7.00/MF $1.75

Some linguistic and semantic theories are reviewed, and an open discussion on syntactical structures is presented. Generalizations, and some examples are given for the following topics: paradigmatic versus syntagmatic order and meaning, associations between meanings of components in syntactically-combined expressions, intersection of classes (additive features), associations between linearly-sequential elements; nodes that fail to produce semantic linkage, linguistically transitive expressions which are also logically transitive, semantic processes in the structure of a complex expression, metalanguage versus semantic language for semantic description, and the dichotomy of well-formed and uninterpretable expressions. The view is expressed that if there is to be a semantic theory which accounts for all sorts of deviant uses of language, an infinite number of dictionaries will be needed to provide for all possible misuses of the word which every speaker will nevertheless understand. R.U.

N66-38930# Massachusetts Inst. of Tech., Cambridge.
STRUCTURAL SEMANTICS: THEORY OF SENTENTIAL MEANING
Elinor Charney *In* Wayne State Univ. Proc. of the Conf. on Computer-Related Semantic Anal. 1965 13 p (See N66-38926 24-08) CFSTI: HC $7.00/MF $1.75

Linguistic and semantic concepts of the various types of sentence are reviewed. The linguistic meaning, the cognitive meaning, and the abstract sentential meaning of sentences are illustrated by examples. Metalingual concepts such as objective referent, sentence-abstract, token-bound sentences, referential context of sentences, and the operational meaning (in contradistinction to the syntactic significance) of the formal syntactic characteristics and the descriptive meaning of descriptive terms. Emphasis is placed on comprehension from the syntagmatic position in the chain of speech of natural language utterances. With regard to machine translation and data retrieval, the viewpoint is expressed that structural synonymity laws are important for the theory of interlingual mechanical translation since they are useful for establishing sentence-by-sentence translation laws. The preservation of the correct abstract sentential meaning is necessary when inputting one natural language into a system which is

expected to convey the same abstract sentential meaning in another natural language having a different grammatical structure. R.U.

N66-38931# Cambridge Language Research Unit (England).
SEMANTIC ALGORITHMS
Margaret Masterman *In* Wayne State Univ. Proc. of the Conf. on Computer-Related Semantic Anal. 1965 49 p refs Sponsored by ONR, Dept. of Navy, Office for Sci. and Tech. Inform., and Natl. Res. Council (See N66-38926 24-08) CFSTI: HC $7.00/MF $1.75

Viewpoints on computing semantic paragraph patterns are presented; the following semantic concepts are included: the semantic unit of phrasing, quatrains (coupled pairs of phrasings), the semantic middle term (pairing templates), the philosophical notion of the semantic square, and the two-phrasing paragraph with the notion of permitted couples. The hypothesis is presented that the semantic unit of language (phrasing) is given by intonational and phonetic data and is not perspicuous from written speech. The creation of a pidgin language, the full structure of which can really be mechanically determined by the strict use of the scientific-linguistic methods of complementary distributions, is mentioned. A bibliography and several appendices are included on such topics as: comparative quatrain analyses of English and French; examples of the algorithm of removing the primary and secondary stresses from texts and then trying to guess at the message from these alone; and, an extract from a computer printout of an interlingua sample. R.U.

N66-38932# Leeds Univ. (England).
SOME QUANTITATIVE PROBLEMS IN SEMANTICS AND LEXICOLOGY
Stephen Ullmann *In* Wayne State Univ. Proc. of the Conf. on Computer-Related Semantic Anal. 1965 10 p (See N66-38926 24-08) CFSTI: HC $7.00/MF $1.75

Some quantitative aspects of semantics and lexicology are discussed under the dichotomy: synchronic properties, and diachronic tendencies. A coding project for the electronic computer, considered as a bookkeeping aid in language data collection, is mentioned. Discussed are the four sets of synchronic problems in meaning: motivation, synonymy, polyvalency, and semantic topology. The coding of computer input meaning in the light of diachronic (historical) tendencies is outlined under the concepts of: extensions and restriction of meanings, anthropomorphic metaphors, and synaesthetic metaphors. Appendixes cover: workd-structure and homonymy in English, synaesthetic metaphors in Keats, the influx of French words into English, and the intake of live new words and meanings into English. R.U.

N66-38933# Harvard Univ., Cambridge, Mass. Center for Cognitive Studies.
PROBLEMS IN AUTOMATIC WORD DISAMBIGUATION
Herbert Rubenstein *In* Wayne State Univ. Proc. of the Conf. on Computer-Related Semantic Anal. 1965 10 p refs (See N66-38926 24-08) CFSTI: HC $7.00/MF $1.75

Computer coding for the reduction of word ambiguities (disambiguation) is proposed. The specific research task is to discover the information necessary to enable a computer to take an isolated English sentence containing one or more homographs and list all the meanings of the homographs acceptable to a native speaker and only those meanings. Presupposed is a computer program syntactic analysis to obviate syntatic ambiguities such as: They (are flying) planes versus They are (flying planes). For the proposed disambiguation, a dictionary of syntactic and semantic information pertinent to word distribution, along with a set of rules governing the application of this information is required. It is considered that the task of finding semantic components bears at least a superficial resemblance to the task of finding distinctive features in phonology, and that the crux of this problem is to obtain semantic features that serve to disambiguate homographs. A linguistic solution to the problem is suggested. R.U.

N66-38934# Hungarian Academy of Sciences, Budapest. Computing Centre.
SOME SEMANTIC RELATIONS IN NATURAL LANGUAGE
Ferenc Kiefer *In* Wayne State Univ. Proc. of the Conf. on Computer-Related Semantic Anal. 1965 12 p refs (See N66-38926 24-08) CFSTI: HC $7.00/MF $1.75

Presented is a configuration of a hierarchical structure between semantic categories, as well as an arbitrary category C^0 characterizing each element out of the vocabulary of a given natural language. Various semantic relations are defined which may prove useful in semantic analysis. R.U.

N66-38935# Massachusetts Inst. of Tech., Cambridge.
UNDERLYING STRUCTURES IN DISCOURSE
Thomas G. Bever and John Robert Ross (Harvard Univ., Cambridge, Mass.) *In* Wayne State Univ. Proc. of the Conf. on Computer-Related Semantic Anal. 1965 6 p refs (See N66-38926 24-08) CFSTI: HC $7.00/MF $1.75

Semantic theories are advanced on problems which arise in the attempt to give a precise characterization of the properties that make a sequence of sentence into a coherent text. The problem of semantic interpretation of discourses is considered, and examples are given. The question is raised as to whether it is likely that underlying structures for discourse, whatever they turn out to look like, can be generated by a device that has no access to extralinguistic material. It is suggested that while it may be possible to state discourse formation rules which provide an account of structure in discourse, the problem of connectedness in discourse cannot be solved within the confines of linguistics. R.U.

N66-38936# Harvard Univ., Cambridge, Mass.
MULTIDIMENSIONAL SCALING AND SEMANTIC DOMAIN
A. Kimball Romney *In* Wayne State Univ. Proc. of the Conf. on Computer-Related Semantic Anal. 1965 10 p refs (See N66-38926 24-08) CFSTI: HC $7.00/MF $1.75

Preliminary results of research are reported on some ways in which semantic domains vary in internal structure. A semantic domain is defined as an organized set of words (or unitary lexemes), all on the same level of contrast, that refer to a single conceptual sphere. Emphasis is placed on making inferences about structure from the distance among items in the semantic domain. The domain of color in English is considered, and by utilizing a multidimensional scaling technique (the triad method), data were collected on six common English color terms from sixty college students. Among the conclusions advanced were: (1) Different semantic domains may exhibit quite different structures. (2) Measures of similarity as represented in the triad test add information that is complementary to information arrived at by more strictly linguistic methods. (3) The most variability from individual to individual in the structuring of semantic domains occurred with a more complex structure, such as a paradigm. R.U.

N66-38937# Cambridge Language Research Unit (England).
SEMANTIC CLASSES AND SEMANTIC MESSAGE FORMS
Karen Sparck Jones *In* Wayne State Univ. Proc. of the Conf. on Computer-Related Semantic Anal. 1965 10 p refs (See N66-38926 24-08) CFSTI: HC $7.00/MF $1.75

A summary of ideas for investigating one aspect of semantic analysis is presented. Two concepts considered are: the semantic class, and the semantic message form. For a semantic class, consideration is given to the paradigmatic relations between the word in a vocabulary; and for a semantic message, to the syntagmatic relation between the words in a text. Linguistic examples are given on how to investigate these concepts. R.U.

N66-38938# Texas Univ., Austin. Linguistics Research Center.
SEMANTIC SELF-ORGANIZATION
Eugene D. Pendergraft *In* Wayne State Univ. Proc. of the Conf. on Computer-Related Semantic Anal. 1965 8 p refs (See N66-38926 24-08) CFSTI: HC $7.00/MF $1.75

An extension to the next level of the hierarchical linguistic model of an experimental design to include relations characterized as semantic rather than syntactic is discussed. Reviewed is a formal working hypothesis on automatic linguistic classification (regarded as consisting of those operations that, when successful, result in a taxonomy of objects based on their empirically given properties or relations). A self-organizing system is defined as one carrying out a particular strategy in automatic classification, the strategy being especially suitable when the properties or relations of a large universe of objects are presented over a period of time in successive experiences; each experience may contribute new evidence about the way the objects should be classified. The key to the strategy is a processing cycle in which deduction and induction alternate. By means of automatic classification, appropriate modifications in the taxonomy are induced from statistics which are collected on relations between inferential events in this deductive process. R.Ll.

N66-38939# International Business Machines Corp., Yorktown Heights, N. Y.
A TAG LANGUAGE FOR SYNTACTIC AND SEMANTIC ANALYSIS
Warren J. Plath *In* Wayne State Univ. Proc. of the Conf. on Computer-Related Semantic Anal. 1965 10 p refs (See N66-38926 24-08) CFSTI: HC $7.00/MF $1.75

A brief linguistic description is presented of a problem-oriented language designed for writing phrase structure parsing rules, and some possibilities of employing the language in automatic semantic analysis are explored. The tag (or attribute-value pair) is defined as a basic notational device employed within the language to represent the substructure of constituents. The potentialities of the tag language as a tool for carrying out a limited form of semantic analysis are briefly demonstrated by examples. R.Ll.

N66-38940# Istituto Documentazione Della Associazione Meccanica Italiana, Milan.
AN APPROACH TO THE SEMANTICS OF PREPOSITIONS
Ernst von Glaserfeld *In* Wayne State Univ. Proc. of the Conf. on Computer-Related Semantic Anal. 1965 13 p refs (See N66-38926 24-08) CFSTI: HC $7.00/MF $1.75
(Grant AF-EOAR-65-76)

In assessing workable procedures for machine translation, the problems created by prepositions in a natural language text are reviewed. The analysis of prepositions is considered as belonging to the field of semantics because the analysis of prepositions, and of relations in general, is to ensure that the relations expressed in a given sentence remain unchanged when the sentence is translated into another language. It is pointed out that for documentation purposes, it is necessary to resolve any ambiguity in sentence meaning, since different relations, as a rule, require different output. The problem of isolating specific relations is mentioned, and a coding system for identifying prepositions is explained. Given the system of relation-indices, it is considered that the correlational analysis procedure eliminates a type of pseudo-ambiguity. R.Ll.

N66-39051# Joint Publications Research Service, Washington, D. C.
RADIO INDUSTRY PRODUCTS, ANALOG COMPUTATION EQUIPMENT, VOLUME IV
G. M. Petrov, ed. 6 Oct. 1966 116 p Transl. into ENGLISH of the Catalog "Izdeliya Radiopromychlennosti, Analogovaya Vychislitel'noya Tekhnika, tom IV" Moscow, 1966 p 1-88
(JPRS-38038; TT-66-34465) CFSTI: $4.00

Descriptions, diagrams and photographs, specifications and dimensions, and basic data are given on various analog computation equations, analog computers for differential equations in partial derivatives, auxiliary apparatus and standardized units for analog rivatives, auxiliary apparatus and standardized units for analog computers, cathode ray indicators, infra-low frequency instrument assembly, electronic stabilized power sources, and analog-digital devices for conversion and recording of information. L.E.W.

N66-39170# California Univ., Davis.
COMPUTER PROGRAMMING AND DATA STORAGE, APPENDIX D
Frank V. Jones *In its* Invest. of Energy, Momentum and Mass Transfer Near the Ground Jun. 1966 p 227-228 refs (See N66-39148 24-20) CFSTI: HC $6.00/MF $1.50

The methods of data processing are outlined in a program to measure air drag forces by a 50-ton shear stress lysimeter and to measure eddy heat flow and moisture transfer near the ground. It is reported that use of the data has been greatly facilitated by adopting standardized forms for recording all scan schedules, instrument types, serial numbers, locations in field, heights above or below ground level, input voltages, etc. These are supplemented by frequent entries in a run log recording particular activities, instrument adjustments, events, and weather information. Included are the formats and methods of computer programming basic to processing and reducing the data on an IBM 7040. C.T.C.

N66-39295*# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
A HYBRID GRAPHICAL DISPLAY TECHNIQUE
Huber L. Graham May 1966 50 p refs
(Grant NsG-496; Contract Nonr-4102(01); Proj. MAC)
(NASA-CR-78744; ESL-R-270) CFSTI: HC $2.00/MF $0.50 CSCL 09B

An on-line graphical display technique and an experimental system prototype employing this technique are discussed. Unlike some methods, which display graphical data by point-plotting or by piecewise-linear segments, this technique employs a sequence of curved segments. This approach results in compact storage of the digital commands that describe a complex curve at the expense of some computing time necessary to establish these commands. The prototype system, which is based on this technique, is relatively uncomplicated and inexpensive; therefore, it is suited for use at the remote consoles of a time-shared computer facility. Author

N66-39383# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foriegn Technology Div.
HIGHER TECHNICAL SCHOOL. COMPUTER ENGINEERING SELECTED ARTICLES
9 May 1966 38 p refs Transl. into ENGLISH from Vychislitel'naya Tekhn. (Moscow), v. 4, 1964 p 42-48, 53-67
(FTD-TT-65-1596; TT-66-62053; AD-637110) CFSTI: HC $2.00/MF $0.50

CONTENTS:

1. ONE METHOD OF ESTIMATING THE ALGORITHMS OF A SOLVABLE PROBLEM A. Ya. Savel'yev p 1-9 (See N66-39384 24-08)
2. IMPROVEMENT OF THE ACCURACY CHARACTERISTICS OF ANALOG-DIGITAL CONVERTERS N. N. Ustinov and V. V. Meyer p 10-27 refs (See N66-39385 24-08)

N66-39384# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ONE METHOD OF ESTIMATING THE ALGORITHMS OF A SOLVABLE PROBLEM
A. Ya. Savel'yev *In its* Higher Tech. School. Computer Eng. 9 May 1966 p 1-9 (See N66-39383 24-08) CFSTI: HC $2.00/MF $0.50

The problems of estimating the various solution algorithms for a given problem are examined. A specific example is presented and digital computer design relations are given. Several solution algorithms are compared for one problem with emphasis placed

on both the structural and logical complexity of each algorithm. The volume of calculations for the algorithms are evaluated from the qualitative and quantitative point of view. A.G.O.

N66-39385# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
IMPROVEMENT OF THE ACCURACY CHARACTERISTICS OF ANALOG-DIGITAL CONVERTERS
N. N. Ustinov and V. V. Meyer *In its* Higher Tech. School. Computer Eng. 9 May 1966 p 10–27 refs (See N66-39383 24-08) CFSTI: HC $2.00/MF $0.50

The problem of conversion of voltage to a binary code with a running relative error not greater than a specified value is investigated. Several block diagrams for such converters are presented, and the distinctive features of each are examined. On the basis of data given it is pointed out that conversion by the method of comparison and subtraction, despite the greater complexity of the circuitry, in principle, will permit achieving the required running relative error at low input signal levels, whereas by the method of time coding, with consideration of the present state of comparison systems, such a problem cannot be solved. A.G.O.

N66-39455# International Business Machines Corp., Yorktown Heights, N. Y. Thomas J. Watson Research Center.
RESEARCH ON ADVANCED COMPUTER METHODS FOR BIOLOGICAL DATA PROCESSING Final Report, 15 Jul. 1964–14 Jul. 1965
D. N. Streeter and J. Raviv Wright-Patterson AFB, Ohio, AMRL, Apr. 1966 57 p refs
(Contract AF 33(615)-2047)
(RC-1513; AMRL-TR-66-24; AD-637452) CFSTI: HC $3.00/MF $0.50

The purpose of the research is the development of mathematical methods and computer programs for the extraction of meaningful information from biological, primarily neurophysiological, measurements. Emphasis was placed on statistical methods suitable for separating two or more random signals and which provide insight into the underlying mechanism by which the signals are generated. Loeve-Karhunen expansion and discriminant analysis methods are applied to the problem of time signal classification. Experiments are performed both on computer generated time signals and on electroencephalograms. Methods of coping with the singularity problem arising from a small sample size are investigated Author (TAB)

N66-39472# Massachusetts Inst. of Tech., Cambridge.
INPUT/OUTPUT IN TIME-SHARED, SEGMENTED, MULTIPROCESSOR SYSTEM
Arthur Anshel Smith (M.S. Thesis) Jun. 1966 75 p refs
(Contract Nonr-4102(01); Proj. Mac)
(MAC-TR-28; AD-637215) CFSTI: HC $3.00/MF $0.75

After introducing and defining the concepts of time-sharing, segmentation, and multiprocessing, two classes of systems incorporating these are introduced. Both classes use associative memories, as 'look behind' devices to speed the operation of addressing the segmented memory, with the distinction between classes being the location of the associative memory. In one class, there is one associative memory for each processing element, no matter how many main memory units are connected to a processor; in the second class, there is one associative memory for each main memory unit, with the processors sharing the associative memory. After introducing two criteria for input/output systems, that the overhead associated with their use be small and that they may be physically and logically simple, and describing further operations of the systems, it is concluded that members of the second class, having shared associative memories, best meet these criteria. Author (TAB)

N66-39477# Aerospace Medical Div. Aerospace Medical Research Labs.
PROGRAMMING TECHNIQUES FOR THE AUTOMATIC MONITORING OF HUMAN PERFORMANCE Technical Report, Nov. 1964–Aug. 1965
Patricia A. Knoop Apr. 1966 59 p refs
(AMRL-TR-66-16; AD-637454) CFSTI: HC $3.00/MF $0.75

The report describes the organizational and operational design of a digital computer program for the automatic monitoring of human performance during simulated training missions. The computer program, now in its developmental stage, is designed to serve the dual and interdependent purposes of (1) assisting in the analysis and determination of meaningful performance measures and performance criteria and (2) using these criteria to automatically monitor human performance, including performance evaluation (scoring), adaptive task sequencing, and the automatic initiation of simulated system malfunctions for training in emergency procedures. A description is provided of a criteria format that aids the user of the automatic monitoring program in defining criteria with variable tolerances for conceivably any aerospace task or mission. Some projections are made about possible uses of the research-oriented automatic monitoring program to (a) vary criteria as the skill level of a particular student increases, (b) hold selected flight variables constant to allow the teaching of isolated skills on a progressive basis, (c) effect 'overlearning' of selected skills by controlling the outputs to the cockpit, and (d) aid in debugging simulation programs. A topical flow-chart is provided for the entire automatic monitoring program. Author (TAB)

N66-39518# RAND Corp., Santa Monica, Calif.
COMPUTER ROUTINES TO READ NATURAL TEXT WITH COMPLEX FORMATS
Patricia A. Graves, David G. Hays, Martin Kay, and Theodore W. Ziehe Aug. 1966 141 p
(Contract AF 49(638)-1700; Proj. RAND)
(RM-4920-PR; AD-637303) CFSTI: HC $4.00/MF $1.00

The memorandum describes a set of subroutines for the IBM 7040/44 computers for reading textual material with complex formats and coding conventions--questionnaires, library catalog cards, et.--from any external medium into the high-speed store of the machine. Different kinds of information in the input are recognized by explicit markers, position on the line or page, or syntactic clues given by other items. Less complex material requires only a portion of the system. Information may be recoded according to the users conventions before being delivered to his program. The routines may be called from either FORTRAN- or MAP-coded programs Author (TAB)

N66-39524# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTRONIC DIGITAL COMPUTERS
L. K. Golyshev 1 Apr. 1966 57 p Transl. into ENGLISH of Chapter 14 of the book "Elektronnye Tsifrovyye Vychislitel'nyye Mashiny" Kiev, Izd. Tekhn., 1965 p 382–424
(FTD-MT-66-05; TT-66-62102; AD-637429) CFSTI: HC $3.00/MF $0.50

Contents: Machines for solution of scientific and engineering problems; calculating systems; peculiarities of specialized digital computers for scientific and engineering investigations; machines for solution of planning and economic problems; information about control systems prospects of application of electronic digital computers. TAB

N66-39539*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A GENERALIZED SATELLITE TELEMETRY DATA SIMULATION PROGRAM
Bernard G. Narrow and Richard C. Lee Washington, NASA, Nov. 1966 15 p
(NASA-TN-D-3704) CFSTI: HC $1.00/MF $0.50 CSCL 09B

This document describes a Data Simulation Computer Program which generates test tapes to be used for debugging or testing satellite telemetry computer programs. Test tapes may be generated for all presently defined satellite projects. Besides being used directly by programmers, analysts, and experimenters, the test tapes can be a valuable aid to NASA personnel responsible for attesting to the adequacy of computer programs developed under contract. Over-all benefits offered by the Data Simulation Computer Program are a substantial increase in the degree of assurance that a given computer program is adequately debugged prior to actual use, a reduction in the effort required by the programmer in generating test data, the elimination of erroneous test data due to clerical errors, and a reduction in the time required for debugging programs. Author

N66-39602# System Development Corp., Santa Monica, Calif.
DEVELOPMENT OF EQUATION FOR ESTIMATING THE COSTS OF COMPUTER PROGRAM PRODUCTION
V. La Bolle Bedford, Mass., AFSC, Electron. Systems Div., Jun. 1966 57 p
(Contract AF 19(628)-5166)
(TM-2918/000/00; ESD-TR-66-350; AD-637760) CFSTI: HC $3.00/MF $0.50

The report summarizes System Development Corporation (SDC) Technical Memorandum TM-2712 (AD-631 259). Additional sets of equations are given. Each set contains four equations, each equation shows how to form an estimate for one of the cost measures--number of man months, computer hours, new machine language instructions, months elapsed--by combining numerical values for selected factors that influence these costs. This report reviews the development of these equations including the application of statistical methods such as correlation and multivariate regression to experience data that characterize 74 computer programming efforts completed at SDC. The earlier work in the first cycle, a similar analysis of data for 27 SDC computer programming efforts, is also described. After the publication of TM-2712, the second cycle was continued by additional analysis of the same SDC data for 74 computer programming efforts. The aim of the additional work was to improve the estimating precision of the equations presented in TM-2712. The improvements reported were achieved by deriving new cost equations, one set based upon a truncated sample and then three sets based upon three subsamples of the data. An interim evaluation of the work completed in the first and second cycles presents proposed improvements in approach and research methods. Author (TAB)

N66-39627# Northwestern Univ., Evanston, Ill. Information-Processing and Control Systems Lab.
DETERMINATION OF EXPECTED LONGEST CARRY PROPAGATION LENGTHS BINARY ADDITION OF SIGNED NUMBERS
Chao C. Yang and Sik S. Yau Jun. 1966 40 p refs
(Contract N00014-66-C0020-A03; Grant AF-AFOSR-98-65)
(TR-66-101; AD-637761) CFSTI: HC $2.00/MF $0.50

The expected longest carry delay of asynchronous self-timing additions and the expected maximum number of processing cycles of synchronous iterative additions for signed binary numbers are exactly determined. The former depends on the longest carry propagation lengths due to either zero or nonzero carries, whereas the latter depends only on the longest nonzero carry propagation lengths. The signed numbers are represented by 2s complement notation. It is found that the enormous possible combinations for binary additions of signed numbers and their longest carry delays can be expressed by some recursive formulas if state representations of allowable addition processes (without overflow) are employed. By this method, efficient computer programmings are written to determine exactly the expected longest carry delays for asynchronous additions and the expected maximum numbers of processing cycles for synchronous iterative additions. The results for n = 2 through n = 48, where n is the number of bits of the summands, are given. The dependence relations of these delays on n are also considered. (Author) TAB

N66-39685# Stanford Research Inst., Menlo Park, Calif.
INVESTIGATION OF PROPAGATION-LIMITED COMPUTER NETWORKS, PHASE III Final Report, 1 Jun. 1965-31 May 1966
Bernard Elspas, Karl N. Levitt, Jack Goldberg, Marshall C. Pease, Milton W. Green et al Jun. 1966 267 p refs
(Contract AF 19(628)-2902)
(AFCRL-64-376(III); AD-637769) CFSTI: HC $6.00/MF $1.50

The report summarizes the results of the third year of research on techniques for the analysis, organization, and design of logical networks in which the propagation delays on the lines interconnecting the operational blocks of the network are appreciable compared to the delays within the blocks. During this reporting period, technical advances have been made in the area of purely asynchronous logic theory and design, in the newly posed area of locally synchronous network layout and design, and in the area of advanced computer organizations that take advantage of the characteristics of the propagation-limited assumptions. In asynchronous design theory, previous results on the state-logic relations for autonomous, nonsingular networks are extended to include the more general, and potentially much more economically realizable case where the network may be singular. Further, the totally sequential properties of networks composed of NOR elements with limited fan-in and fan-out are extensively examined with a view to determining their sequential machine behavior. The ultimate objective of this part of the study is to understand the relationships between the state-graph behavior that is possible and realistic limitations that may be imposed on the logic blocks. Finally, a particular problem concerned with the initialization of antiparallel control logic modules is considered. TAB

N66-39719*# Arinc Research Corp., Washington, D. C.
DESCRIPTION OF THE COMPUTERIZED RELIABILITY ANALYSIS METHOD (CRAM) Research Monograph No. 11
David E. Van Tijn 13 Nov. 1964 104 p ref
Publ.-294-02-14-444
(Contract NAS8-11087)
(NASA-CR-78859) CFSTI: HC $4.00/MF $0.75 CSCL 09B

The detailed procedures for using computers to perform the tedious calculations required in reliability prediction are discussed. The system, its applicability, and limitations are outlined. The procedural rules and scheduling chart are given as guides to the management of reliability analysis. Engineering analysis is emphasized, including block naming, list preparation, reliability diagram construction, and failure mode and effect analysis. N.E.A.

N66-39742# Massachusetts Inst. of Tech., Cambridge.
MODELS AND DATA STRUCTURES FOR DIGITAL LOGIC SIMULATION
Donald Leigh Smith (M.S. Thesis) Aug. 1966 148 p refs
(Contract Nonr-4102(01); Proj. Mac)
(MAC-TR-31; AD-637192) CFSTI: HC $4.00/MF $1.00

A digital logic simulation system is proposed for design verification. Logic to be simulated is specified with a high-level register transfer design language, and the simulation system operates on-line on a large time-shared computer. The problem of selecting adequate circuit and signal models for this purpose is considered. Models are proposed with sufficient timing detail to allow the simulation system to detect timing errors which currently are found by manual checking or prototype debugging. A data structure for representing idealized circuit and signal models and a matching simulation algorithm is discussed. The data structure is a direct representation of a complete subset of the design language and is organized so that it can be incrementally modified to reflect design changes. The simulation algorithm is very efficient

because combinational levels are re-evaluated only if their values are needed and may have changed since last evaluated. The data structure is expanded to represent detailed circuit and signal models. A method of intermixing idealized and detailed models and efficiently simulating very large designs is discussed. Extensions are proposed to the design language so that it can be used to specify model parameters and serve as the simulation command language Author (TAB)

N66-39747# Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.

ICES-SEPOL I: A SETTLEMENT PROBLEM ORIENTED LANGUAGE SYSTEMS DESIGN

Robert L. Schiffman and Robert V. Whitman Jan. 1966 86 p refs *Its* Soils Publ.-191

(Contract Nonr-4102(01))

(T-66-3; AD-637524) CFSTI: HC $3.00/MF $0.75

ICES-SEPOL (Soil Engineering Problem-Oriented Computer Language) is a subsystem of ICES I which is designed to aid civil engineers in the calculation of predicted manitudes and progress of settlement for shallow foundations. Thu system is of use for the design of buildings, earth dams, highway embankments and other foundations which cause spread loadings at or near the surface of the soil. ICES-SEPOL I consists of (1) a command-structured problem-oriented language for the description of the problem and the specification of the procedures to be performed in solving the problem and (2) a set of processing routines for performing the computations specified by the engineer in the commands. ICES-SEPOL I is confined to states of stress in a semi-infinite solid due to vertical surface loads Author (TAB)

N66-39821# United Kingdom Atomic Energy Authority, Harwell (England). Electronics and Applied Physics Div.

AUTOTOGGLE—AN AID TO PDP8 PROGRAM DEBUGGING

G. C. Best Jul. 1966 12 p

(AERE-R-5244) HMSO: 2s 6d

A simple method of debugging program material for the PDP8 computer by providing a typed analysis of the program operations is described. Author

N66-39852# Sylvania Electric Products, Inc., Mountain View, Calif. Electronic Defense Labs.

DIGITAL COMPUTER ESTIMATION OF SYSTEM PARAMETERS UTILIZING INPUT-OUTPUT DATA

John P. Mc Guire Ft. Monmouth, N. J., Army Electron. Command, Aug. 1966 114 p refs

(Contract DA-28-043-AMC-01829(E))

(EDL-M875; ECOM-01829-M875; AD-637199) CFSTI: HC $4.00/MF $0.75

This report develops a method for system parameter estimation from test data using a digital computer and the test data in digitized form. All a priori information concerning the system is incorporated in the computer model. It is assumed that the input and output data are available and, when necessary, the effect of additive noise due to transmission and reception of this informating is accounted for Author (TAB)

N66-39882# United Kingdom Atomic Energy Authority, Harwell (England). Solid State Physics Div.

A NEW TIME-OF-FLIGHT DATA PROCESSING SYSTEM

J. W. Hall Jul. 1966 16 p refs

(AERE-R-5237) HMSO: 3s

Existing systems for processing time-of-flight data are of insufficient capacity and flexibility to meet foreseeable needs. Some possible developments are discussed and the most suitable system is examined in detail. This system uses a small computer as a temporary store for incoming data. The number of events in each time-of-flight channel is held on a magnetic drum and these numbers are up-dated sequentially from the computer store. When the conditions of an experiment are changed the data from the drum is transferred to tape for output or (later) for transfer back to the drum if required. Using a PDP-8 computer allows 10^5 channels to be available on line with this system. Author

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N66-38863# Joint Publications Research Service, Washington, D. C.

DESIGN PRINCIPLES FOR THREE-BEAM KINESCOPES OF THE CHROMATRON TYPE

A. P. Angaforov *In its* 22d All-Union Sci. Session devoted to Radio Day. Sect. on Television 9 Sep. 1966 p 27-32 (See N66-38847 24-07) CFSTI: $3.00

Some of the advantages of three-beam kinescopes with a tricolor facsimile screen and a focusing grid (a tube of the chromatron type) over tubes of the masked type are discussed. One of the most important problems in designing these tubes is the need for minimum nonuniformity in the spacing of beam traces which permits the use of the screen with a constant one color band spacing. The beam trace spacing can be aligned by using a cylindrical screen assembly. The cylindrical surface of the grid permits a simplification of the realization of dynamic convergence. The decrease in the angle of incidence of the beam with respect to the grid permits an increase in the maximum angle of deviation or a decrease in the requirements on the accuracy of manufacturing and assembling the parts of the screen assembly. The screen may be coated over the external surface of the forward glass of the bulb which allows an increase in the useful area of the image and simplifies the construction of the screen assembly. The contrast and brightness of the image are also improved. The method used for calculating the screen assembly of the cylindrical type can also be used for single beam chromatrons. R.N.A.

N66-38860# Joint Publications Research Service, Washington, D. C.

PROBLEMS IN AUTOMATION OF THE CONTROL OF THE PARAMETERS OF TELEVISION RECEIVER TUBES IN MASS PRODUCTION

A. D. Kostinskiy *In its* 22d All-Union Sci. Session Devoted to Radio Day. Sect. on Television 9 Sep. 1966 p 67-71 refs (See N66-38847 24-07) CFSTI: $3.00

Automatic test equipment is described which was designed to increase the quality control during the production of television receiver tubes by automatically measuring tube parameters to detect any defects. The system measures such important parameters as modulation characteristics, gasiness, filament current, electrode leakage current, brightness, color of the luminescent screen, and resolution capacity. The use of this equipment sharply increases tube production, increases test objectivity, increases the reliability and accuracy of the measurements, automatically documents the test results, directs data output to computers for processing, and frees human controllers from monotonous labor. A detailed description of the equipment operation is included. R.N.A.

N66-38864# Japan Atomic Energy Research Inst., Ibaraki.

A LOW-DRIFT SOLID-STATE dc AMPLIFIER

N. Wayakama and T. Furukawa *In* IAEA Nucl. Electron. 1966 p 171-184 refs (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

This paper describes a solid-state d.c. amplifier developed for low-level current measurement and discusses the design of this system consisting of a parametric modulator, a carrier oscillator, an a.c. amplifier, a demodulator, and an output amplifier. The parametric modulator employing silicon diodes is suitable for amplification of low-level d.c. current, since the input resistance is generally high and the conversion noise is small. In this system, base-emitter junctions of silicon planer transistors are used as parametric diodes, and the modulating frequency and amplitude chosen are 100 kc/s and 100 mV. A conversion gain of this modulator is about 90 dB in current. A crystal oscillator is employed for carrier generation. The a.c. amplifier consists of a directly-coupled a.c. amplifier whose transfer inpedance is $1\times10^{8}\Omega$, a band-pass amplifier whose voltage gain is about 50 dB, and an emitter follower circuit. A normally connected transistor chopper as the demodulator is followed by a direct-coupled amplifier of low-output inpedance having gain of 30 dB in order to provide wide dynamic range. Over-all d.c. negative feedback is provided by the feedback resistor. The complete system gives an open-loop transfer impedance of $3\times10^{16}\Omega$ and maximum output of ±15 V. Current drift and voltage drift referred to input are less than 1×10^{-15}A and 0.2 mV respectively in the range of 10–35°C, and fluctuation or short-term drift is less than 2×10^{-16}A. This d.c. amplifier can be applied to the picoammeter, the log-N amplifier and various other scientific instruments. Author

N66-38887# Joint Inst. for Nuclear Research, Dubna (USSR).
GRID-CONTROLLED PHOTOMULTIPLIERS AS ELEMENTS OF FAST COINCIDENCE CIRCUITS
S. V. Muchin, S. V. Richvitsky, I. N. Semenyushkin, M. Vysocansky (Slovak Acad. of Sci.), and P. Goehrlich et al (VEB Carl Zeiss, Jena, East Germany) *In* IAEA Nucl. Electron. 1966 p 225–229 refs (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

Photomultipliers offering the possibility of rapid control of their sensitivity have been investigated with a view to improving the time analysis of transient processes. The time resolution of photomultipliers with a control grid in the dynode system (FEU-36), with one control grid in the cathode space (61 PK 412), and two control grids in the cathode space (SKP-1), have been tested by controlling with a frequency of 150 Mc/s. When two such controlled photomultipliers are used as elements for the selection of pulses in a coincidence system and they are excited by short light pulses, one obtains a half width of the coincidence curve of $\tau_{50}=0.9...0.7$ ns and a base width at 0.1% of the maximum pulse rate of $\tau_{0.1}=1.5...2.1$ ns. Author

N66-38945*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EVALUATION OF HIGH TEMPERATURE STRANDED HOOK-UP WIRE
Harold J. Moore, Jr. and James H. Donnelly 21 Jun. 1966 55 p refs
(NASA-TM-X-53522) CFSTI: HC $2.50/MF $0.50 CSCL 09A

Selected wires and insulation for space vehicle and ground support equipment applications were evaluated. The types of wire tested were tin-coated copper with irradiated polyolefin insulation; a tin-coated copper with irradiated crosslinked polyalkene and a jacket of radiation-crosslinked polyvinylidene fluoride (Kynar); Teflon (TFE) insulated fine silver; Teflon insulated silver alloy; and Teflon insulated nickel-plated copper with a final plating of silver. Physical, electrical, environmental, and metallurgical testing included measuring of flexibility, tensile strength, conductivity, insulation resistance, temperature resistance, and corrosion resistance. Performance was evaluated in welding, soldering, and stripping tests. The test results will aid in the selection of conductors and insulation materials. K.W.

N66-38978# Texas Instruments, Inc., Dallas.
PRODUCTION ENGINEERING MEASURES (PEM) FOR A GERMANIUM MICROWAVE TRANSISTOR Quarterly Progress Report No. 7, 31 Dec. 1965–31 Mar. 1966
C. L. White, K. B. Landress, and E. Gonzalez-Correa [1966] 42 p refs
(Contract DA-36-039-AMC-03632(E))
(TI-03-66-60; AD-636285) CFSTI: HC $2.00/MF $0.50

The emitter window mask and the emitter 'Top-Hat' mask alignment pattern was redesigned in order to aid the operator in accomplishing a faster and more precise alignment of the emitter 'Top-Hat' mask over the KMER emitter window. A precise alignment of the 'Top-Hat' pattern is an essential technique in defing the emitter region of the active device prior to the emitter alloying process. The abnormally low value for the intrinsic f_T of PEM devices fabricated during the seventh quarter of the contract was corrected by using collector epitaxial-material with a lower than normal resistivity value. A study of the problem of abnormally low intrinsic f_T devices revealed that although the measured resistivity of the epitaxial collector region was as specified, the avalanche breakdown voltage of the fabricated collector-base diode was abnormally high, which in turn indicates an abnormally high value of collector resistivity. Excessive electrical opens were experienced between the emitter and base contacts of the active device during the seventh quarter of this contract. It is believed that the opens problem can be expediently solved by a technique involving the misalignment of the expanded contact 'Top-Hat' pattern during the KMER expanded contact define and etch operation. In addition to the misalignment technique for reducing the number of emitter-base opens, a thinner second silicon dioxide deposition prior to the fabrication of the expanded contact may also aid in reducing open devices. Author (TAB)

N66-38980# Sylvania Electric Products, Inc., Woburn, Mass. Semiconductor Div.
PRODUCTION ENGINEERING MEASURE (PEM) FOR SILICON MIXER DIODE Quarterly Progress Report, 1 Jan.–31 Mar. 1966
G. Bowne, R. Bayliss, and C. Brunquell [1966] 64 p refs
(Contract DA-36-039-AMC-06159(E))
(QPR-4; AD-634862) CFSTI: HC $3.00/MF $0.75

The third engineering test sample run has been completed using the new package design. Thermocompression bonding of two silicon lots and tungsten whiskers with varying wire and point characteristics. Preliminary screening of these units indicate that units with tungsten wire of increased tensile strength can better withstand mechanical and thermal stresses. Step stress analysis of storage life test data on units from the second run show a failure rate of 0.1% per 1000 hours compared to the objective 0.001% level. Author (TAB)

N66-39137*# Ryan Aeronautical Co., San Diego, Calif.
SRD FREQUENCY MULTIPLIERS Interim Report
12 Jul. 1966 72 p ref *Its* Rept.-29169-2
(Contract NAS8-20257)
(NASA-CR-78738) CFSTI: HC $3.00/MF $0.75 CSCL 09A

Special tests and circuits for the shunt step recovery diode (SRD) frequency multipliers, and for series SRD frequency multipliers are presented in connection with fast current switching capabilities. It is stated that the shunt circuit is easier to handle because the various parameters can be identified with physical circuit elements; also, the diode in the shunt circuit can be cooled more efficiently. The series circuit was found to be mechanically less complex, making it more easily adapted to high frequency multipliers. R.U.

N66-39140# Joint Publications Research Service, Washington, D. C.

TWENTY-SECOND ALL-UNION SCIENTIFIC SESSION DEVOTED TO RADIO DAY. SECTION ON RADIO MEASUREMENTS

9 Sep. 1966 38 p refs Transl. into ENGLISH of the publ. "XXII Vsesoyuznaya Nauchnaya Sessiya, Posvyashennaya Dnyu Radio. Sektsiya Radioizmereniy" Moscow, p 1–31 (JPRS-37517; TT-66-33945) CFSTI: $2.00

CONTENTS:

1. A NEW WAVEGUIDE MEASURING LINE METHOD FOR DETERMINATION OF THE SPECIFIC INDUCTIVE CAPACITANCE OF FILM AND SHEET INSULATING MATERIALS Yu. V. Kuznetsov p 1–4 refs (See N66-39141 24-09)

2. A METER FOR DEVIATIONS OF THE POWER LEVEL V. D. Kukush, I. K. Ovchinnikov, Ya. P. Tsar, V. S. Zhilkov, V. F. Pasechnik et al p 5–11 refs (See N66-39142 24-09)

3. MEASURING THE MAGNETIZING FORCE WHEN INVESTIGATING FERRITE MATERIALS USING RADIO FREQUENCY PERMEAMETERS Ya. P. Tsar and V. F. Pasechnik p 12–15 refs (See N66-39143 24-09)

4. SOME PROBLEMS IN THE PROCEDURE FOR MEASURING THE WIDTH OF THE RADIO EMISSION BAND IN THE RANGE 10 KC-30 MEGAHERTZ A. P. Pavlyuk p 16

5. TIME INTERVAL METER L. S. Sitnikov p 17

6. METHODS FOR MEASURING QUASIHARMONIC SIGNALS Yu. E. Aptek p 18

7. MEASUREMENT OF THE DELAY TIME IN LINEAR CHANNELS USING THE NOISE PULSE METHOD K. G. Kir'yanov p 19

8. THE USE OF HOMODYNE FREQUENCY CONVERSION WITH APPLICATION OF FREQUENCY MODULATION OF THE SVCH (SUPER HIGH FREQUENCY) GENERATOR IN HIGH-SPEED ELECTRONIC PHASE METERS V. V. Khilil' p 20–27 refs (See N66-39144 24-09)

9. MEASUREMENT OF SMALL PHASE ANGLES IN THE SVCH RANGE USING THE HOMODYNE METHOD OF FREQUENCY CONVERSION V. V. Khilil' p 28–32 ref (See N66-39145 24-09)

N66-39141# Joint Publications Research Service, Washington, D. C.

A NEW WAVEGUIDE MEASURING LINE METHOD FOR DETERMINATION OF THE SPECIFIC INDUCTIVE CAPACITANCE OF FILM AND SHEET INSULATING MATERIALS

Yu. V. Kuznetsov *In its* 22d All-Union Sci. Session devoted to Radio Day. Sect. on Radio Meas. 9 Sep. 1966 p 1–4 refs (See N66-39140 24-09) CFSTI: $2.00

To achieve increased efficiency in measuring comparatively thin films, a theory is advanced for a new waveguide method to determine the specific inductive capacitance of insulating materials by a special arrangement of samples. This theory is based on the solution of the boundary problem of propagation of electromagnetic waves along waveguides with a stratified structure. A formula specifies the case of the dielectric parameters of the plate in the waveguide. The value of the root of the characteristic equation may be calculated from an equation showing the propagation constant of the wave in a laminated waveguide. It is pointed out that this method may be used not only for measuring the dielectric properties of thin sheet materials, but also for measuring the thickness of materials, and some physical parameters of the materials related to their dielectric properties. R.Ll.

N66-39142# Joint Publications Research Service, Washington, D. C.

A METER FOR DEVIATIONS OF THE POWER LEVEL

V. D. Kukush, I. K. Ovchinnikov, Ya. P. Tsar, V. S. Zhilkov, V. F. Pasechnik et al *In its* 22d All-Union Sci. Session devoted to Radio Day. Sect. on Radio Meas. 9 Sep. 1966 p 5–11 refs (See N66-39140 24-09) CFSTI: $2.00

To investigate the output characteristics of super-high frequency generators in the 2–4 cycle range, an apparatus, consisting of a balanced static calorimeter and a metering block, was designed. A schematic diagram of a balanced static calorimeter with automatic balancing is shown. Supplementary investigations indicate the possibility of using this device for measurements in other wave ranges where coaxial lines are used without changing the structure and diagram of the instrument. The principle used may be extended to other power levels and transmission lines, and the device developed is considered to be suitable for applications in the radio engineering industry. R.Ll.

N66-39143# Joint Publications Research Service, Washington, D. C.

MEASURING THE MAGNETIZING FORCE WHEN INVESTIGATING FERRITE MATERIALS USING RADIO FREQUENCY PERMEAMETERS

Ya. P. Tsar and V. F. Pasechnik *In its* 22d All-Union Sci. Session devoted to Radio Day. Sect. on Radio Meas. 9 Sep. 1966 p 12–15 refs (See N66-39140 24-09) CFSTI: $2.00

By using the general theory of passive transfer quadrupoles, the problem of exact determination of the magnetizing force in the investigated core located in the cavity of a permeameter is solved. The indicated procedure for measuring the magnetic field intensity in the secondary circuit of the permeameter can be applied to the testing of ferrite materials. It is considered that the use of expressions and nomograms obtained permits measuring the magnetic field intensity in the cavity of a radio frequency permeameter more exactly and simply than the known procedures. The accuracy in measuring the modulus of the magnetic field intensity to a significant extent depends on the accuracy in measuring the quality factory of the primary circuit of the permeameter. R.Ll.

N66-39144# Joint Publications Research Service, Washington, D. C.

THE USE OF HOMODYNE FREQUENCY CONVERSION WITH APPLICATION OF FREQUENCY MODULATION OF THE SVCH (SUPER HIGH FREQUENCY) GENERATOR IN HIGH-SPEED ELECTRONIC PHASE METERS

V. V. Khilil' *In its* 22d All-Union Sci. Session devoted to Radio Day. Sect. on Radio Meas. 9 Sep. 1966 p 20–27 refs (See N66-39140 24-09) CFSTI: $2.00

For measuring the phase shift in the millimeter wave range, the homodyne methods of frequency conversion are described. In homodyne conversion the mixer is supplied with oscillations from the same generator. For realization of homodyne conversion all the basic types of modulation are used: amplitude, phase, and frequency. In the range of millimeter waves the greatest advantages are found when using the homodyne conversion with frequency modulations since the majority of generators used in the super-high frequency range permit rapid frequency variation within broad limits. A block diagram of the phase meter depicts homodyne conversion used with frequency modulation, and oscillograms show the voltage formed at the output of the mixer for three values of the measured angle. The investigated method of modulation is considered to permit realization of the homodyne conversion practically for any frequency of the modulation oscillations, limited only by the maximum allowable frequency deviation. R.Ll.

N66-39145# Joint Publications Research Service, Washington, D. C.

MEASUREMENT OF SMALL PHASE ANGLES IN THE SVCH RANGE USING THE HOMODYNE METHOD OF FREQUENCY CONVERSION

V. V. Khilil' *In its* 22d All-Union Sci. Session devoted to Radio Day. Sect. on Radio Meas. 9 Sep. 1966 p 28–32 ref (See N66-39140 24-09) CFSTI: $2.00

Considered are gas-discharge plasma investigations, characterized by the fact that in the majority of experiments the plasma itself is a medium with rapidly varying parameters, and the presence of powerful energy sources required for the formation of gas discharge leads to the occurrence of strong noise. For such cases, metering apparatus are required to provide sufficient noise protection and great accuracy when determining rapidly varying parameters. A homodyne phase meter was designed and developed for measuring phase angles in the superhigh frequency range on the order of tenths of degrees. Results show that the instrument has great noise resistance and permits measurements of phase shifts on the order of several degrees even under conditions of strong noise inherent in apparatus in which high temperature plasma is being investigated. R.Li.

N66-39187# Joint Publications Research Service, Washington, D. C.

A SUPERREGENERATIVE AMPLIFIER MADE OF A TUNNEL DIODE WITHOUT AN EXTERNAL SOURCE OF AUXILIARY VOLTAGE

E. A. Akchurin *In its* Twenty-second All-Union Sci. Session devoted to Radio Day. Sect. on Radio Receivers and Amplifiers 9 Sep. 1966 p 1–5 refs (See N66-39186 24-10) CFSTI: $4.00

An autooscillation system is described which uses a tunnel diode as the active element of the superregenerator with an RC circuit. It is considered that the only method of matching the functions of the superregeneration amplifier and the auxiliary oscillator in one device is the use of the two-circuit oscillatory system. It is pointed out that the two-circuit oscillatory system must be used only at those frequencies where it is possible to select a sufficiently large ratio of the frequencies of the basic and auxiliary oscillations. N.E.N.

N66-39188# Joint Publications Research Service, Washington, D. C.

THE PROBLEMS OF CONSTRUCTION OF COOLED SVCH (SUPERHIGH FREQUENCY) CONVERTORS

V. N. Alfeyev and V. D. Yekimov *In its* Twenty-second All-Union Sci. Session devoted to Radio Day. Sect. on Radio Receivers and Amplifiers 9 Sep. 1966 p 6–12 refs (See N66-39186 24-10) CFSTI: $4.00

The noise temperature from a cooled convertor is described, and expressions are presented for the noise temperature under various conditions. Characteristics of the diode from different semiconductor materials at different temperatures are given in graphed form. The basic parameters which determine the properties of the cooled convertor are identified. By using a cooled intermediate-frequency preamplifier with a cooled convertor it was found that a noise temperature could be obtained on the order of 500° K with cooling to the temperature of liquid nitrogen and on the order of 120° K with cooling to the temperature of liquid helium. N.E.N.

N66-39189# Joint Publications Research Service, Washington, D. C.

INDIUM ANTIMONIDE AND ITS USE IN COOLED DEVICES WITH FREQUENCY CONVERSION

V. N. Alfeyev, V. D. Yekimov, V. V. Galavanov, and L. N. Radaykina *In its* Twenty-second All-Union Sci. Session devoted to Radio Day. Sect. on Radio Receivers and Amplifiers 9 Sep. 1966 p 13–18 refs (See N66-39186 24-10) CFSTI: $4.00

The properties of indium antimonide, and the characteristics of InSb diodes are reviewed. It is pointed out that InSb is a prospective material for the manufacture of diodes and transistors operating at low temperatures. Graphs are included for the dependency of the noise temperature of a converter using InSb diodes on the cooling temperature, and for the dependency of the noise coefficient of the converter on the voltage of positive displacement with heterodyne currents at low temperature. N.E.N.

N66-39190# Joint Publications Research Service, Washington, D. C.

THE INFLUENCE OF A NONLINEAR DIODE CAPACITANCE ON THE CHARACTERISTICS OF AN AMPLITUDE DETECTOR

A. M. Mallyar *In its* Twenty-second All-Union Sci. Session devoted to Radio Day. Sect. on Radio Receivers and Amplifiers 9 Sep. 1966 p 19–21 (See N66-39186 24-10) CFSTI: $4.00

The large input capacitance variations of the detectors using point silicon or germanium diodes are considered. The frequency to which the detector may be tuned to achieve a noticeable decrease in the nonlinearity of the detector characteristic is given. Expressions are also given for the coefficient of nonlinear distortions with respect to the second harmonic and to the third harmonic. Nonlinear distortions are mentioned, and graphs which permit evaluation of the distortions or detuning are included. N.E.N.

N66-39191# Joint Publications Research Service, Washington, D. C.

A PHASE DETECTOR WITH A SMALL PULSATION COEFFICIENT AND A SMALL TIME CONSTANT

V. I. Turchenkov *In its* Twenty-second All-Union Sci. Session devoted to Radio Day. Sect. on Radio Receivers and Amplifiers 9 Sep. 1966 p 22–26 (See N66-39186 24-10) CFSTI: $4.00

The procedures for construction of phase detectors with small pulsation coefficients are reviewed, and a phase detector somewhat free of the inadequacies inherent in the systems is described. The switching cycle and condenser voltage are mentioned, and one possible system for the phase detector is illustrated. N.E.N.

N66-39192# Joint Publications Research Service, Washington, D. C.

THE NOISE COEFFICIENT OF A QUADRUPOLE WITH A NEGATIVE SOURCE RESISTANCE

I. L. Polyakov *In its* Twenty-second All-Union Sci. Session devoted to Radio Day. Sect. on Radio Receivers and Amplifiers 9 Sep. 1966 p 27–31 refs (See N66-39186 24-10) CFSTI: $4.00

The noise coefficient is determined using the equivalent diagram of a noisy quadrupole, with the quadrupole replaced by one which is not noisy but with the same amplification parameters. It was concluded that (1) the minimum value of the noise coefficient occurs for identical absolute values of the source conductance independently of the sign, and (2) the minimum value of the noise coefficient of the quadrupole referred to the source with negative conductance is less by a defined amount. N.E.N.

N66-39201# Joint Publications Research Service, Washington, D. C.

PARAMETRIC RESISTANCE DIPOLES

V. A. Arbuznikov and L. A. Arbuznikov *In its* Twenty-second All-Union Sci. Session devoted to Radio Day. Sect. on Radio Receivers and Amplifiers 9 Sep. 1966 p 86–91 refs (See N66-39186 24-10) CFSTI: $4.00

Parametric resistance dipoles with parameters that vary in time according to a harmonic law, designated PGD (parametric harmonic dipoles), are considered. Differential equations are formulated which relate the instantaneous values of voltage and current to describe parametric resistance circuits. The effect of harmonic frequency oscillations on PGD is also considered. Simple PGD circuit diagrams are included and discussed in relation to the various spectra. It is noted that for small depth of modulation of the parameter, the spectral components decrease rapidly with an increase in the number n. For large depth of modulation of the parameters, the spectrum decreases slowly. L.E.W.

N66-39204# Joint Publications Research Service, Washington, D. C.

INVESTIGATION OF SINGLE CASCADE RC-AMPLIFIER MADE OF TUNNEL DIODES AND THE REGION OF AVERAGE FREQUENCY

I. A. Dubrovskiy *In its* Twenty-second All-Union Sci. Session devoted to Radio Day. Sect. on Radio Receivers and Amplifiers 9 Sep. 1966 p 101–106 refs (See N66-39186 24-10) CFSTI: $4.00

Analytical data are presented on a parallel cascade, a series cascade with electrical connection, and a series cascade with capacitance connection. Equations are derived to determine the amplification coefficient with respect to voltage; load resistance is not considered. The stability reserve coefficient is also introduced. Based on these analyses, certain basic assumptions are made pertaining to amplification properties and coefficients, time and temperature instabilities, and oscillator resistance. M.G.J.

N66-39205# Joint Publications Research Service, Washington, D. C.

THE MUTUAL CORRECTION OF FREQUENCY CHARACTERISTICS AND WIDE BAND AMPLIFIERS

V. I. Ageyev *In its* Twenty-second All-Union Sci. Session devoted to Radio Day. Sect. on Radio Receivers and Amplifiers 9 Sep. 1966 p 107–113 refs (See N66-39186 24-10) CFSTI: $4.00

Mathematical equations are derived for constructing a multicascade wide band amplifier (with more than three cascades) made of mutually corrected pairs and triplets. Graphs are also presented to depict the dependencies of gain with respect to amplification on the relative amplification Y_{BN} for a different number of cascades n. The gain increases noticeably with an increase in Y_{BN} to 0.8 to 0.9; to obtain the greatest gain the amplifier must be constructed with a maximum number of mutually corrected triplets. It is pointed out that by using mutually corrected pairs and triplets, the number of cascades can be decreased by 15% to 25% in comparison with the amplifier made up of identical cascades for small values of Y_{BN} = 0.85 to 0.95, and the same amplification. Economy in feed power is also considered. Experimental tests were made on a model amplifier made of four, five, and six different band cascades. It was found that the experiment characteristics correspond well to the calculated ones: for resultant frequency distortions of 1 dB, the scattering does not exceed 0.1 dB. M.G.J.

N66-39206# Joint Publications Research Service, Washington, D. C.

MULTIPHASE CIRCUITS AS A PROCEDURE FOR INCREASING THE AMPLITUDINAL LINEARITY OF WIDE BAND AMPLIFIERS

V. D. Chelyshev *In its* Twenty-second All-Union Sci. Session devoted to Radio Day. Sect. on Radio Receivers and Amplifiers 9 Sep. 1966 p 114–118 ref (See N66-39186 24-10) CFSTI: $4.00

Circuits based on two-cycle construction (parallel and cascade multiphase) are briefly considered. The parallel multiphase system represents a device consisting of parallel wideband amplifiers and made of nonlinear elements. The two-cycle, three-phase, and two-phase systems are described. The differences between the two-cascade and the two-cycle systems are outlined. It is concluded that the two-phase circuit is the simplest of wideband amplification circuits for compensating the nonlinear noise. N.E.N.

N66-39207# Joint Publications Research Service, Washington, D. C.

A UNIVERSAL METHOD FOR CALCULATING CASCADES WITH LOW FREQUENCY CORRECTION

G. V. Voyshvillo *In its* Twenty-second All-Union Sci. Session devoted to Radio Day. Sect. on Radio Receivers and Amplifiers 9 Sep. 1966 p 119–123 refs (See N66-39186 24-10) CFSTI: $4.00

The proposed caluclation method requires no assumptions and is considered suitable for transistor and tube cascades operating both in the transient and in the stationary condition for any porosity and shape of the output voltage. The method is based on the use of the characteristics of the transient condition with reference to the tube cascade with a specified resistance in the grid circuit. Equations are also developed for calculating the elements of low frequency correction for operation of the stationary conditions. N.E.N.

N66-39208# Joint Publications Research Service, Washington, D. C.

EVALUATION OF THE EFFICIENCY OF MUTUAL CORRECTION IN A NUMBER OF VERSIONS OF TWO-CASCADE AMPLIFIERS

I. V. Suslov *In its* Twenty-second All-Union Sci. Session devoted to Radio Day. Sect. on Radio Receivers and Amplifiers 9 Sep. 1966 p 124–130 refs (See N66-39186 24-10) CFSTI: $4.00

Two-cascade amplifiers constructed with various combinations of correction circuits are investigated. The amplifier with series correction in each cascade with the parasitic capacitance concentrated at the output of the quadrupole of intercascade communication, and the amplifier consisting of one cascade with a series inductance correction and one with parallel correction are considered. Among the conclusions are: (1) The parallel inductance correction is most effective in each cascade. (2) The transfer capacitance lowers the efficiency of the mutual correction. N.E.N.

N66-39211# Library of Congress, Washington, D. C. Aerospace Technology Div.

POWER CONDITIONING DEVICES—ANALYTICAL SURVEY

Surveys of Foreign Scientific and Technical Literature

Joseph Podoski 28 Jun. 1966 176 p refs (ATD-66-82)

CONTENTS:

1. POWER CONDITIONING DEVICES p 3–32 refs

2. ABSTRACTS AND TRANSLATIONS p 33–106 refs

3. CHOICE OF THE OPTIMUM TRANSFORMATION RATIO IN SYSTEMS OF CONVERSION WITH IMPACT EXCITATION M. V. Agapov p 107–110 refs (See N66-39212 24-09)

4. USE OF THE HALL EFFECT FOR CONVERTING DIRECT TO ALTERNATING CURRENT G. E. Alekseeva and L. P. Melishkina p 111–112 refs (See N66-39213 24-09)

5. VOLTAGE TRANSFORMER USING POWER RESISTOR G. N. Berestovskii and K. Ya. Senatorov p 113–124 refs (See N66-39214 24-09)

6. INVERTED CONVERTERS WHICH ARE BASED ON THE p-n JUNCTION NONLINEAR CAPACITANCE L. S. Berman p 125–126 refs (See N66-39215 24-09)

7. DIRECT TO ALTERNATING CURRENT CONVERTER BASED ON HALL'S EFFECT V. N. Bogomolov, N. S. Nikolayenko, and V. P. Fedotov p 127–128 (See N66-39216 24-09)

8. A TRANSISTORIZED STABILIZED CONVERTER N. I. Burenkov, V. A. Voronov, and F. Ya. Sal'man p 129–131 (See N66-39217 24-09)

9. TRANSISTOR D-C CONVERTER WITH MAGNETIC STABILIZATION N. K. Ganskau and M. E. Poyurovskii p 132–133 (See N66-39218 24-09)

10. CONVERTERS FOR TRANSFORMING d-c CURRENT INTO HIGHTER SUPPLY VOLTAGE A. G. Gontsov p 134 (See N66-39219 24-09)

11. TRANSISTOR dc CONVERTERS FOR INSTRUMENT AMPLIFIERS K. B. Karandeev, V. I. Gol'dgefter, and M. G. Mizyuk p 135–137 refs (See N66-39220 24-09)

12. PPT-2 DIRECT CURRENT CONVERTER M. B. Kotov p 138–139 refs (See N66-39221 24-09)

13. STATIC 50-CYCLE TO 300-CYCLE FREQUENCY CONVERTER A. V. Lashas p 140 (See N66-39222 24-09)

14. A POWER PACK FOR AN ELECTRON MICROSCOPE TYPE UEMV-100 V. V. Polivanov, V. V. Il'in, A. V. Iz''yurov, R. V. Pogudina, and N. I. Pyatakov p 141–144 refs (See N66-39223 24-09)

15. SEMICONDUCTOR dc CONVERTERS G. S. Tyskin p 145–158 refs (See N66-39224 24-09)

N66-39212# Library of Congress, Washington, D. C. Aerospace Technology Div.

CHOICE OF THE OPTIMUM TRANSFORMATION RATIO IN SYSTEMS OF CONVERSION WITH IMPACT EXCITATION

M. V. Agapov *In its* Power Conditioning Devices 28 Jun. 1966 p 107–110 refs Transl. into ENGLISH from Radiotekhn. (Moscow), v. 15, no. 11, 1960 p 47–49 (See N66-39211 24-03)

The choice of the optimum transformation ratio for high-voltage converter circuit is discussed. The converter is assumed to be operating under conditions of impact oscillation. Its purpose is to supply cathode-ray tubes. Theoretical relationships are introduced which make it possible to select the approximate value of this ratio which will satisfy the conditions of maximum efficiency and maximum rectified output voltage. Author

N66-39213# Library of Congress, Washington, D. C. Aerospace Technology Div.

USE OF THE HALL EFFECT FOR CONVERTING DIRECT TO ALTERNATING CURRENT

G. E. Alekseeva and L. P. Melishkina *In its* Power Conditioning Devices 28 Jun. 1966 p 111–112 refs Transl. into ENGLISH from Pribory i Tekhn. Eksperim. (USSR), no. 2, 1958 p 100–101 (See N66-39211 24-09)

The use of the Hall effect is considered for conversion of a constant voltage of small magnitude into an alternating one. In order to increase sensitivity a method is proposed for lowering the parasitic emfs induced in the semiconductor transducer, by means of the introduction of compensating counter-emfs, and the use of a selective amplifier with semiconductor triodes. Experimental data are given for the conversion of dc voltages of about 10 to 50 μV into sinusoidal voltages. Author

N66-39214# Library of Congress, Washington, D. C. Aerospace Technology Div.

VOLTAGE TRANSFORMER USING POWER RESISTOR

G. N. Berestovskii and K. Ya. Senatorov *In its* Power Conditioning Devices 28 Jun. 1966 p 113–124 refs Transl. into ENGLISH from Radiotekhn. i Elektron. (USSR), v. 2, no. 9, 1957 p 1178–1188 (See N66-39211 24-09)

The physical processes in voltage transformers employing power transistors are analyzed. Formulae and graphs are given for the design of circuits for prescribed power-supply output power and voltage. The characteristics of domestic power transistors in the saturation region are given. Author

N66-39215# Library of Congress, Washington, D. C. Aerospace Technology Div.

INVERTED CONVERTERS WHICH ARE BASED ON THE p–n JUNCTION NONLINEAR CAPACITANCE

L. S. Berman *In its* Power Conditioning Devices 28 Jun. 1966 p 125–126 refs Transl. into ENGLISH from Pribory i Tekhn. Eksperim. (USSR), no. 3, 1961 p 168–169 (See N66-39211 24-09)

The converter is described and represented schematically. To avoid nonlinear effects, a circuit voltage of 125 mV and a 2.5 coefficient of the p–n junction coupling with the inductor were chosen. The converter's sensitivity threshold was determined by the temperature dependence of the p–n junctions. N.A.S.

N66-39216# Library of Congress, Washington, D. C. Aerospace Technology Div.

DIRECT TO ALTERNATING CURRENT CONVERTER BASED ON HALL'S EFFECT

V. N. Bogomolov, N. S. Nikolayenko, and V. P. Fedotov *In its* Power Conditioning Devices 28 Jun. 1966 p 127–128 Transl. into ENGLISH from Pribory i Tekhn. Eksperim. (USSR), no. 2, 1959 p 134–135 (See N66-39211 24-09)

A semiconductor converter of direct to alternating current is described. The converter's sensitivity of 50 cps amounts to several μV. The converter has an unlimited life, is robust mechanically, and can be used as a component for dividing or multiplying two voltages. Author

N66-39217# Library of Congress, Washington, D. C. Aerospace Technology Div.

A TRANSISTORIZED STABILIZED CONVERTER

N. I. Burenkov, V. A. Voronov, and F. Ya. Sal'man *In its* Power Conditioning Devices 28 Jun. 1966 p 129–131 Transl. into ENGLISH from Pribory i Tekhn. Eksperim. (USSR), no. 6, 1960 p 124–126 (See N66-39211 24-09)

The compact converter is described. The input voltage is 25 V; the output voltages are 21.5, 350 and 150 V; the overall power drawn is 200 W and the efficiency is 85%. The stability remains within the limits of 1% when the input voltage varies over the range −10% to +20% of the nominal voltage. Author

N66-39218# Library of Congress, Washington, D. C. Aerospace Technology Div.

TRANSISTOR D-C CONVERTER WITH MAGNETIC STABILIZATION

N. K. Ganskau and M. E. Poyurovskii *In its* Power Conditioning Devices 28 Jun. 1966 p 132–133 Transl. into ENGLISH from Priborostroenie (Moscow), no. 1, 1961 p 13–15 (See N66-39211 24-09)

Details are presented for the design and construction of a compact transistor and heater supply source with a high degree of stabilization, comparatively high efficiency, and stability against vibration. The properties of the supply unit are given. Because of different stabilization requirements, the supply unit consists of two converters; a high voltage converter which is a self-oscillator generating square voltage pulses, and a low voltage converter which is a transistor amplifier receiving the input signal from the high voltage converter. Schematics are included for the basic circuitry of the converter, a circuit of a semiconductor filter, and a circuit for testing and selecting transistors. N.A.S.

N66-39219# Library of Congress, Washington, D. C. Aerospace Technology Div.

CONVERTERS FOR TRANSFORMING D-C CURRENT INTO HIGHER SUPPLY VOLTAGE

A. G. Gontsov *In its* Power Conditioning Devices 28 Jun. 1966 p 134 Transl. into ENGLISH from Pribory i Tekhn. Eksperim. (USSR), no. 2, 1963 p 175 (See N66-39211 24-09)

Schematics are presented for two semiconductor converters; one with self-excitation and the other with power amplification. The converters were designed for a supply voltage of 27 to 30 V, an output voltage of 200 V, a power up to 200 W, and an efficiency of 75% to 80%. The design is based on a bridge circuit where the back voltage to the transistor does not exceed the supply voltage. The master oscillator in the converter with power amplification is based on an autotransformer circuit with a common base and joint collectors. N.A.S.

N66-39220# Library of Congress, Washington, D. C. Aerospace Technology Div.

TRANSISTOR DC CONVERTERS FOR INSTRUMENT AMPLIFIERS

K. B. Karandeev, V. I. Gol'dgefter, and M. G. Mizyuk *In its* Power Conditioning Devices 28 Jun. 1966 p 135–137 refs Transl. into ENGLISH from Pribory i Tekhn. Eksperim. (USSR), no. 2, 1959 p 62–64 (See N66-39211 24-09)

Techniques are presented for the conversion of weak dc signals by transistors operating in a condition of controlled resistance. The specific transistor requirements are defined. For converter operation, transistors with low values of residual voltage and residual current are suggested. Another requirement is a low product of resistance between the emitter and the collector in the "on" position and conductance between the emitter and the collector in the "off" position. Discussed are the relationships between: (1) the transistor "on" resistance and the residual voltage to the control current, (2) the effective value of the first harmonic at the output of a transformerless converter and the direct voltage at its input, and (3) the effective value of the first harmonic at the output of the full-wave converter and the direct input voltage. Both relationships (2) and (3) are presented for temperatures of 20° and 50°C. N.A.S.

N66-39221# Library of Congress, Washington, D. C. Aerospace Technology Div.

PPT-2 DIRECT CURRENT CONVERTER

B. M. Kotov *In its* Power Conditioning Devices 28 Jun. 1966 p 138–139 Transl. into ENGLISH from Pribory i Tekhn. Eksperim. (USSR), no. 2, 1962 p 177–178 (See N66-39211 24-09)

A schematic is presented for the converter, a self-exciting push-pull oscillator. The converter, using storage batteries as the primary source of direct current, was designed to convert 24 V±10% dc to 220 V±10% ac with a frequency of 50 cps±15%. The shape of the output voltage is nearly square. With an effective power of 200 W, the efficiency is less than 80%. The overall dimensions are 280×210×230 mm with a weight of 10 kg. N.A.S.

N66-39222# Library of Congress, Washington, D. C. Aerospace Technology Div.

STATIC 50-CYCLE TO 300-CYCLE FREQUENCY CONVERTER

A. V. Lashas *In its* Power Conditioning Devices 28 Jun. 1966 p 140 Transl. into ENGLISH from Pribory i Tekhn. Eksperim. (USSR), no. 1, 1960 p 135 (See N66-39211 24-09)

For operation as a simple and reliable source of audiofrequency current, the converter was designed to transform 50-cycle alternating current to 300-cycle sinusoidal current. A schematic and a description are presented. The circuit is based on the use of the nonlinear properties of iron. N.A.S.

N66-39223# Library of Congress, Washington, D. C. Aerospace Technology Div.

A POWER PACK FOR AN ELECTRON MICROSCOPE TYPE UEMV-100

V. V. Polivanov, V. V. Il'in, A. V. Iz"yurov, R. V. Pogudina, and N. I. Pyatakov *In its* Power Conditioning Devices 28 Jun. 1966 p 141–144 refs Transl. into ENGLISH from Pribory i Tekhn. Eksperim. (USSR), no. 5, 1960 p 147–151 (See N66-39211 24-09)

A power pack for the high-resolution (10 A) electron microscope is described. The power pack for the microscope lenses is very reliable, simple, small in size, and has improved operational properties. The instability of the accelerating voltage was reduced to 0.003%. Author

N66-39224# Library of Congress, Washington, D. C. Aerospace Technology Div.

SEMICONDUCTOR DC CONVERTERS

G. S. Tyskin *In its* Power Conditioning Devices 28 Jun. 1966 p 145–158 refs Transl. into ENGLISH from Radiotekhn. (Moscow), v. 12, no. 12, 1957 p 56–62 (See N66-39211 24-09)

Methods of converting a direct current from one voltage level to another with a power suitable for electronic apparatus are examined. A transistor power amplifier switching circuit which is controlled by a master oscillator is recommended for this purpose. The basic properties of the circuit and the method of design are described. Author

N66-39439# Utah Univ., Salt Lake City. Microwave Device and Physical Electronics Lab.

ROTATING BEAM INTERACTION IN WAVEGUIDE Technical Report, Jun. 1963–Jun. 1965

C. H. Durney, C. C. Johnson, and R. L. Schriever Wright-Patterson AFB, Ohio, AF Avionics Lab., Jul. 1966 90 p refs

(Contract AF 33(657)-8677)

(AFAL-TR-66-107; AD-486580)

Fast-wave microwave devices using rotating or periodic electron beams in waveguide have been the subject of considerable interest because of their prospects for high power and efficiency well into the millimeter wave region. The early experimental findings were inconclusive and the basic nature of the interaction is not fully understood. This report contains a coupled-mode theory of the interaction between a rotating electric beam in waveguide. The purpose for carrying out this theory is to utilize the clear physical understanding inherent in a coupled-mode theory, as well as the quantitative results, as a basis for research on the device. The theory may be used to investigate a variety of devices. The modes involved in the interaction are obtained, and gain and beam modulation information is given for specific devices. It is recommended that the analysis be systematically applied to promising device types in order to predict the type and strength of interaction involved. Author (TAB)

N66-39491# Army Electronics Labs., Fort Monmouth, N. J.

OPERATION OF THE INTEGRATED DISTRIBUTED AMPLIFIER TYPE Z-5278

M. M. Chrepta Jun. 1966 17 p ref

(ECOM-2723; AD-637304) CFSTI: HC $1.00/MF $0.50

The integrated distributed amplifier developed under electronics command contracts is a significant improvement over conventional lumped tube amplifiers in size, weight, and bandwidth. The single envelope, two-sided structure lends itself to flexibility of operation, increased overall efficiency, and simplification of equipment maintenance. The design also is attractive for much higher power amplifiers as well as for low-power drivers. The integrated distributed amplifier would provide significant improvements in communications equipment where complex tuning mechanisms over wide bands are used. Author (TAB)

N66-39512# Texas Instruments, Inc., Dallas.

PRODUCTION ENGINEERING MEASURES (PEM) FOR MILLIWATT LOGIC SEMICONDUCTOR INTEGRATED CIRCUITS Quarterly Progress Report No. 8, 1 Apr.–30 Jun. 1966

[1966] 13 p

(Contract DA-36-039-AMC-03637(E))

(TI-03-66-78; AD-637449) CFSTI: HC $1.00/MF $0.50

Investigation continued during the second quarter on improved alloy-mounting techniques, including ultrasonic machine alloying. Approval was received from the sponsoring agency on qualification of milliwatt logic devices to the R-13 Specification. Tape programmed machine probing underwent further refinements. (Author) TAB

N66-39513# Texas Instruments, Inc., Dallas.

PRODUCTION ENGINEERING MEASURES (PEM) FOR MILLIWATT LOGIC SEMICONDUCTOR INTEGRATED CIRCUITS Quarterly Progress Report No. 7, 1 Jan.–30 Mar. 1966

[1966] 17 p

(Contract DA-36-039-AMC-03637(E))

(TI-03-66-77; AD-637448) CFSTI: HC $1.00/MF $0.50

A bonder certification program was initiated during the last quarter of 1965 to improve process flow by reducing pre-cap inspection requirements. Tests completed in December, 1965, resulted in fabrication of new scribe head with an improved Tempress diamond, which resulted in increased yields and permitted the operator to make necessary adjustments. Work continued on adjusting millivolt offset between a minimum of 15 and a maximum of 50. This program was continuing at the end of the quarter. Pyrolytic oxide was added after emitter to improve contact probe yields and increase pinhole protection. This process was added to the production process. Permission was granted to Texas Instruments on February 9, 1966, by 'the sponsoring agency' to start a qualification program. The first automatic probe system from the Transistor Automation Corporation was delivered the latter part of February, 1966. It was in full operation by March 1, 1966. Author (TAB)

N66-39514# Texas Instruments, Inc., Dallas.
PRODUCTION ENGINEERING MEASURES (PEM) FOR MILLIWATT LOGIC SEMICONDUCTOR INTEGRATED CIRCUITS Quarterly Progress Report No. 6, 1 Oct.–31 Dec. 1965 [1966] 14 p
(Contract DA-36-039-AMC-03637(E))
(TI-03-66-76; AD-637447) CFSTI: HC $1.00/MF $0.50

A bonder certification program was initiated during the fourth quarter to improve process flow by reducing pre-cap inspection requirements. A study initiated in October resulted in fabrication of a new scribe head with an improved Tempress diamond, which resulted in increased yields and permitted the operator to make necessary adjustments. Corrective action trials were initiated in the gold doping process with different N2 bake temperatures, diffusion times, and evaporation charges. This program was continuing at the end of the quarter. Double coat - double expose processes were tested at fourth (contact) etch, resulting in a 95 percent reduction in oxide pinholes. This process was added to the production process in December. Transistor Automation Corporation of Cambridge, Mass. was engaged to design a new, fully automatic functional probing machine. Work is continuing on the machine design and fabrication. A tape programmed d-c test machine was placed in operation in the final test area and additional machines were ordered. (Author) TAB

N66-39528*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DEGRADATION OF TRANSISTOR PERFORMANCE DUE TO PASSAGE OF SMALL-COULOMB HIGH-VOLTAGE SURGES
Norman M. Garrahan Sep. 1966 13 p
(NASA-TM-X-55572; X-711-66-449) CFSTI: HC $1.00/MF $0.50
CSCL 09A

In order to determine the effects of high-voltage-pulse transients on transistor life and beta stability, a few selected transistors were subjected to a series of randomly applied high-voltage pulses across the base-emitter junction. It was found that successive high-voltage pulses caused a gradual beta degradation and drop in junction resistance, with a need for increased base-current drive for a measureable non-zero beta. As the amplitude of the pulses was increased, a point was reached where the transistor open-circuited. This report describes a brief empirical qualitative check made on a few selected transistors to help arrive at a quick solution to production failures of transistors in potting molds. Author

N66-39547# National Co., Inc., Melrose, Mass.
PRODUCTION ENGINEERING MEASURE FOR CESIUM BEAM TUBES Quarterly Progress Report, 23 Aug.–23 Nov. 1965
James George [1965] 19 p
(Contract DA-36-039-AMC-01457)
(QPR-10; AD-637619) CFSTI: HC $1.00/MF $0.50

The retrofitted PEM-E3 cesium beam tube under life test exhibited decreases in low-frequency (20 kc/s) flop signal and cesium background and an increase in potassium background. However, the ac signal-to-noise ratio (in a 3 c/s bandwidth) remained a satisfactory 45 db. (This ratio is the most significant criterion for satisfactory performance of the beam tube in the electronic system.) Of course, after an accumulated operating life of 12,484 normal beam intensity hours as of November 23, 1965, the tube has already exceeded its specified operating life of 10,000 hours. Performance of the retrofitted PEM-E5 and PEM-E6 cesium beam tubes in service-coordinated electronic systems under both laboratory and environmental conditions is satisfactory. The preproduction phase of the manufacturing program was initiated Author (TAB)

N66-39550# Westinghouse Electric Corp., Elmira, N. Y. Electronic Tube Div.
SOLID STATE IMAGE INTENSIFIERS Monthly Technical Engineering Report, 1–30 Jun. 1966
D. C. Fowlis, M. A. Novice, and Z. Szepesi 13 Jul. 1966 8 p
(Contract N61339-66-C-0064)
(MTER-3; AD-637171) CFSTI: HC $1.00/MF $0.50

CdS mixtures of different composition were prepared for making sintered PC layers. Semi-transparent black films deposited on top of the EL layer showed much higher light reflection than those on glass substrates. Smoothening of the EL surface with a thick plastic coating is planned to eliminate this effect. The evaporation technique for making opaque black films was improved, but further work is needed to eliminate the heating of the substrate and to have more uniform films for larger areas. White EL cells were made by mixing blue and yellow EL powders Author (TAB)

N66-39552# Chalmers Univ. of Technology, Goteborg (Sweden). Research Lab. of Electronics.
NONLINEAR TRAVELING WAVE TUBE ANALYSIS WITH TWO SIGNAL FREQUENCIES Research Report No. 59
S. Wallander 1 Apr. 1966 38 p refs *Its* Tech. Note No. 10
(Contract AF 61(052)-594)
(RADC-TR-66-541; AD-637548) CFSTI: HC $2.00/MF $0.50

The mutual nonlinear distortion of two simultaneous signals in a TWT is theoretically investigated. It is shown that minimum phase distortion occurs at a low beam voltage while minimum amplitude distortion occurs at a high beam voltage. The mutual distortion dominated over the self distortion Author (TAB)

N66-39570# Varian Associates, Beverly, Mass. Bomac Div.
PRODUCTION ENGINEERING MEASURE FOR LOW FIELD MAGNETRON BL-234C Quarterly Progress Report, 28 Jan.–28 Apr. 1966
Arnold M. Eldund [1966] 67 p refs
(Contract DA-36-039-AMC-06162(E))
(QPR-4; AD-637749) CFSTI: HC $3.00/MF $0.75

Life tests were continued during this period. Tube no. 11S, which contains the internally heated tungsten dispenser cathode, has been operated 160 hours thus far within specification limits. Tube no. 121, which contains the Semicon Associates nickel matrix cathode, reached end-of-life after 120 RF operating hours. Both tubes have, therefore, exceeded the 100 hour specification requirement. Engineering tubes 11S through 13S, each containing internally heated cathodes, were completed. Two conventionally machined anodes were completed through cold test. Success was reached in processing modified broachs from HS steel to finish machine the anode bore. One of these anodes, however, did not reach final RF evaluation, since heater failure occurred in the internally heated cathode during cathode activation. The other anode is scheduled for assembly in one of the last two engineering tubes. With the successful completion of vibration and shock testing, total environmental testing in accordance with specification requirements was realized. These tests also included humidity, pressure, temperature coefficient, and low temperature operation Author (TAB

N66-39585# Naval Ordnance Lab., Corona, Calif.
EVALUATION OF GAS DIODES XD2B, NE63, XD3B, AND NE64
George R. Bastedo, James C. Chambers, and James R. Sharp, Jr. 12 Aug. 1966 119 p ref
(NOLC-661; AD-637535) CFSTI: HC $4.00/MF $0.75

The General Electric Company XD2B gas diode and its potential replacement, the NE63, were evaluated to determine their comparative acceptability for use in the Mk 312 and Mk 328 Guided Missile Fuzes. A similar evaluation was made of the XD3B and NE64 diodes for use in the Mk 312 fuze. The evaluations consisted of electrical testing under environmental conditions that closely approximated those experienced by the diodes in the fuzes. The test results, which are presented in several appendixes in the form of computer printouts, indicated that the NE63 and NE64 diodes are acceptable for use in their respective fuzes Author (TAB)

N66-39587# Motorola, Inc., Phoenix, Ariz. Semiconductor Products Div.
THIN FILM TECHNIQUES FOR SILICON INTEGRATED CIRCUITS Quarterly Report No. 7, 1 Feb.–30 Apr. 1966
Louis E. Terry Ft. Monmouth, N. J., Army Electron. Command, Jul. 1966 49 p refs
(Contract DA-28-043-AMC-00097(E))
(0-19; ECOM-00097-7; AD-637216) CFSTI: HC $2.00/MF $0.50

Motor drive with speed control installed on cermet powder feed mechanism. Cermet depositions on (a) multiple wafer resistance uniformity and (b) reproducibility in a series of experiments to optimize the deposition and process parameters have been completed. One-thousand hour 200C storage tests completed on 21 canned cermet resistors. Continued plasma anodization of aluminum thin films with new substrate heater-holder installed on the system. Measurements for 0.7 pF/sq mil -20 volt plasma anodized capacitors canned and prestorage were completed. The units are now on 1000 hour storage tests. The Reactive Sputtering power supply has been delivered and is now being installed. Masks for the MIC-C44 linear amplifier and the MIC-C50 gate circuit masks were completed. Circular contact Ni-Cr resistors were deposited in several geometrical configurations and evaluated for high frequency characteristics. (Author) TAB

N66-39645# Radio Corp. of America, Camden, N. J. Communications Systems Div.
MICROMODULE LIFE TEST PROGRAM Final Report
F. E. Farmar Aug. 1966 64 p
(Contract DA-36-039-AMC-01462(E))
(AD-637675) CFSTI: HC $3.00/MF $0.75

Based on over 26 million micromodule hours, the observed MTTF for micromodules is approximately 300,000 hours with continuous operation +65 or 75C. Handling of modules and the physical movement of the test setup during test had a dramatic effect on the reliability of the modules. There is a learning curve or familiarization period associated with new operators and test facilities. There was a positive or upward drift in center frequency of the analog modules. This coupled with the fact that Modules which are tunable should receive periodic center frequency adjustments. On the other hand, if modules are to be completely sealed, they should be tuned to a center frequency slightly below the specified center frequency to allow an upward frequency drift. The variable capacitor used with the DM-3 micromodule is inadequate to withstand the stresses imposed on it in this test. Inadequate mechanical strength may have been a contributing factor to many failures. Improved protection against mechanical stress should be provided. Environmental testing was not effective as a screen to eliminiate potential failures. The reliability of the micromodules tested is probably a function of the amount of experience each vendor had accumulated prior to the production of material for this test. Reliability estimates for the Vendor A modules are probably most nearly representative of what one would achieve in the long run. Analog modules are more subject to degradation failures than digital modules Author (TAB)

N66-39650# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
WORKING ACCURACY OF MECHANICAL PHASE CONVERTER OF ULTRA HIGH FREQUENCY AND CONTINUOUS ACTION
V. L. Gostyukhin 21 Mar. 1966 26 p refs Transl. into ENGLISH from Tr. Aviats. Inst. (Moscow), no. 159, 1964 p 257–272
(FTD-TT-66-60; TT-66-62105; AD-637432) CFSTI: HC $2.00/MF $0.50

Translation of Russian research: working accuracy of mechanical phase converter of ultra high frequency and continuous action. TAB

N66-39654# Army Foreign Science and Technology Center, Washington, D. C.
USE OF ELECTRONIC DIGITAL TECHNIQUE FOR TIME INTERVAL MEASUREMENT
V. A. Zhilin Jul. 1966 14 p refs Transl. into ENGLISH from Tsentr. Nauchn.-Issled. Inst. Morskogo Flota (USSR), no. 98, 1963 p 23–31
(FSTC-HT-23-132-66; TT-66-62133; AD-637627) CFSTI: HC $1.00/MF $0.50

Two circuits used in digital timers are described, one using a delay line and the other using the electronic vernier circuit with auxiliary counting pulses. References are primarily to US literature Author (TAB)

N66-39727# ITT Electron Tube Div., Easton, Pa.
100-KILOVOLT CERAMIC METAL THYRATRON Final Report, 15 Jul. 1963–14 Jan. 1966
H. E. Krefft Jun. 1966 187 p refs *Its* Rept.-9
(Contract DA-36-039-AMC-03272(E))
(ECOM-03272-F; AD-637620) CFSTI: HC $5.00/MF $1.00

A new type of multi-grid ceramic hydrogen thyratron tube was developed and investigated. The periodic or iterative design of the electrode structure features an indefinite number of short planar gradient grids and flat ceramic envelope rings which provide protection against electrical breakdown. Thirty tubes made with three, four, and six grids and as many gaps, demonstrated that operation at 100 kilovolt and an average power of 10 kilowatt can be attained with satisfactory characteristics for anode take-over voltage and time, and jitter. Reproducibility and life test performance were good. Commutation takes place in steps and is associated with instantaneous high voltage gap drops affecting particularly the anode gap. The data obtained through this investigation show that hydrogen thyratrons can be rated at 100 KV or possibly even higher voltages, and that greatly improved reliability can be expected from such multi-grid tubes. The development of tubes with high power ratings operating with a relatively low average anode current and long cathode life seems to be possible. (Author) TAB

N66-39772 Microwave Associates, Inc., Burlington, Mass.
Ku BAND SEMICONDUCTOR DEVICE PRODUCTION ENGINEERING MEASURES PROGRAM Quarterly Progress Report, 27 Jan.–27 Apr. 1966
Paul Basken May 1966 40 p
(Contract DA-36-039-AMC-06176(E))
(QPR-1; AD-637607) CFSTI: HC $2.00/MF $0.50

The results of prior Contract No. DA-36-039-AMC-01387(E) where a high power semiconductor limiter in Ku band was developed, are reviewed. Theoretical study of limiter characteristics is then made. Equivalent circuit calculations of insertion loss and isolation are presented. This is followed by a report on the experimental work during the first quarter of the program which

includes the determination of an optimized limiter mount configuration, a study of reverse biasing the limiter, and an evaluation of a breadboard model limiter Author (TAB)

N66-39847# Loral Electronics Corp., New York.
WIDE BAND FERRIMAGNETIC LIMITER STUDY Interim Report, 16 Nov. 1965–21 Mar. 1966
W. Honig, A. Christopher, and J. Moyse Griffiss AFB, N. Y., RADC, Jul. 1966 65 p refs
(Contract AF 30(602)-3966)
(RADC-TR-66-337; AD-637666) CFSTI: HC $3.00/MF $0.75

A detailed experimental study was made of the frequency selective limiting behavior of coincidence limiters. The measurements on low level signals in the presence of high level signals were made as functions of relative and absolute power levels, frequency separation, and operating frequency with respect to limiter bandpass. A device was developed which acts as an octave band all pass with electronically tunable limiter ranges. It should be useful for most wideband limiter applications. Other techniques were also examined. This included multi-ball resonators, premature decline limiters and subsidiary resonance limiters. Materials work consisted of the fabrication YIG, CALVANBIG, MnZnY, and other materials as spheres and chips. Much of the work was in the S band region, but it appears that extension down to P and L and also up through C and X band can be made Author (TAB)

N66-39885# Atomic Energy Establishment, Winfrith (England). Control and Instrumentation Div.
LOGARITHMIC DC AMPLIFIERS USING ALL SOLID-STATE COMPONENTS
E. P. Fowler May 1966 39 p refs
(AEEW-R-484)

Wide range logarithmic amplifiers can now be built using all solid-state components. They promise to be reliable, require no setting-up, and for special applications they may be extremely simple. The report describes the design of two simple amplifiers covering a range of four decades of input current. This is followed by a general purpose amplifier covering the range of input currents from 10^{-10} A to 10^{-3} A with an accuracy of 0.05 of a decade over the temperature range 0° to 50°C. The circuit principle of the general purpose amplifier is suitable for application to a combined logarithmic and linear instrument. Author

N66-39887*# General Electric Co., Schenectady, N. Y. Tube Dept.
DEVELOPMENT OF HIGH-TEMPERATURE, GAS-FILLED, CERAMIC RECTIFIERS, THYRATRONS, AND VOLTAGE-REFERENCE TUBES Final Report, Dec. 15, 1964–Jan. 26, 1966
E. A. Baum and N. D. Jones [1966] 86 p refs
(Contract NAS3-6469)
(NASA-CR-72054; G-E-SD-514A) CFSTI: HC $2.50/MF $0.75 CSCL 09A

This report covers the work performed on the development of rectifiers, thyratrons and voltage-regulator tubes for operation at up to 800°C in vacuum. Performance and endurance tests were conducted at currents to 15 amperes average, 2000 peak inverse volts and at frequencies to 3200 cycles per second. Endurance tests were run on tubes operating in vacuum at pressures of less than 10^{-6} torr and temperatures of 750°C to 800°C. The designs of the rectifier and thyratron tubes is based on the use of graphite electrodes for reduction of grid and anode emission and to minimize gas clean-up. Voltage-regulator tubes were tested at 800°C in vacuum. The normal running voltage for 60 torr neon pressure was 125 volts, with approximately a 4 percent voltage variation over the range of 25 to 75 milliamperes. Tubes were also endurance tested at 50 milliamperes with the longest operating time being 1510 hours at 800°C. Author

N66-39922*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
ELECTRICAL MAINTENANCE PROGRAM WITHIN THE MANUFACTURING ENGINEERING LABORATORY
W. E. Neisler [1964] 15 p
(NASA-TM-X-59022) CFSTI: HC $1.00/MF $0.50 CSCL 09C

Several steps are described which were initiated to make the electrical maintenance program more effective. These steps involved a closer scrutiny of the machine part and electronic and electrical component inventory, modifications to the Sciaky welders, the installation of log books in the control cabinent of each principle welding system and each complex machine tool, installation of hour meters to measure the elapsed time of operation for each machine, the acquisition of test equipment to improve trouble shooting in convenience and time, and the development of a countdown or checkout procedure which is made before each important weld is to occur. R.N.A.

N66-39990*# Bendix Corp., Baltimore, Md. Friez Instrument Div.
ABSOLUTE-TYPE PRESSURE SWITCH, PHASES I AND II Final Report
Jul. 1966 135 p
(Contract NAS8-20532; Proj. 32-3024)
(NASA-CR-79103) CFSTI: HC $4.00/MF $1.00 CSCL 09A

This report encompasses a review of the study phase and the prototype testing phase of the developmcnt of an absolute-type pressure switch. The results of the study phase provided the necessary information required for selecting the materials, design of the linkage assembly, snap-action mechanism, diaphragms, adjustments and stops to be utilized in the prototype design. The results of the tests conducted showed the prototypes to be satisfactory in the areas of bandwidth, differential pressure, repeatability, transfer time, circuit resistance, temperature compensation and dynamic temperature response. The prototypes under vibration and ac breakdown voltage were not satisfactory and will require additional consideration of the backfill pressure, linkage material, and balanced beam weight. Author

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N66-38837*# Martin Co., Baltimore, Md.
THE DETERMINATION OF ASYMPTOTIC AND PERIODIC BEHAVIOR OF DYNAMIC SYSTEMS ARISING IN CONTROL SYSTEM ANALYSIS Final Report
E. Lefferts and E. Moshang Apr. 1966 145 p refs
(Contract NAS8-20002)
(NASA-CR-78676; ER-14229) CFSTI: HC $4.00/MF $1.00 CSCL 09C

To determine techniques for predicting the asymptotic behavior of a nonlinear control system, four approaches were considered. These approaches, which lend themselves to determining and/or identifying limit cycles or obtaining a bound on the solution to the system, were: (1) small perturbation, (2) piecewise linearization, (3) frequency response methods, and (4) boundedness and Lagrange stability. A mathematical model representing a simplified rigid body vehicle with one slosh mode and a damping coefficient for system nonlinearity is described. A bibliography is presented for a literature survey on the asymptotic behavior of solutions of nonlinear differential equations. Two digital computer programs are included for: (1) the linear optimization problem with a quadradic loss function, and (2) manipulation of polynomials to form a transfer function, extract roots of numerator and denominator

polynomials, and obtain a frequency response. Also considered are construction of a Liapunov function, the general transformation matrix E, and computation of the transition matrix. N.A.S.

N66-38914# Saha Inst. of Nuclear Physics, Calcutta (India).
RESOLVING TIMES OF BINARY SCALERS: AN ANALYTICAL STUDY
S. Chowdhury and B. M. Banerjee *In* IAEA Nucl. Electron 1966 p 623–635 refs (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

Analysis of the Binary Scaler, by the Laplace transform method gives an accurate expression for the variation of anode and grid voltages of the two tubes, but fails to lead to any expression for the resolving time. The phenomenon has been studied analytically to lay down these conditions. Circuits fall into two classes, depending upon whether triggers are injected (a) through diodes or (b) through condensers. A general expression for the resolving time cannot be derived because any one or other condition may become important and determine its value in the end. Resolving time can however be estimated by a detailed computation. The results of such computations in a number of practical cases will be reported. The analysis has been compared with the experimental findings reported previously. It tallies well and even explains the unusual finding that the resolving time is a little greater when a train of three pulses are applied, and that resolution of the third becomes easier if the first two pulses are separated by a longer duration. It points out that the resolving time is most easily improved by a reduction of the anode load; that it depends on the anode to grid coupling network and grid circuit time constants, although it is much smaller than both; that excursion limiting diodes are a great help in reducing the resolving time and making it less dependent on resistor values and supply voltages. The findings of the analysis also justify adequately the circuit configurations of fast tube scalers such as that developed by Muller. Author

N66-38915# Saha Inst. of Nuclear Physics, Calcutta (India).
HARMONIC GENERATION BY PULSE DRIVE
K. S. Patel and B. M. Banerjee *In* IAEA Nucl. Electron. 1966 p 637–644 refs (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

Class-C harmonic generators are limited to usually the third order. Pulse drive through wide band circuits removes this limitation and generation of even the tenth harmonic is practical. Fourier analysis has been used to predict the amplitudes of the harmonics, the dc current and the optimum pulse duration for rectangular, triangular and fractional sine wave pulse forms. In the optimum condition, the harmonic output is inversely proportional to the order and the conversion efficiency from dc to ac is constant. Experiments revealed a difficulty inherent in high-order generation. It was found that the harmonic generated decays in amplitude followed an exponential curve. However, this amplitude fluctuation can be removed easily by a limiter. Experimental set-ups, multiplying frequencies of 200 kc/s to 2 Mc/s, 2 to 20 Mc/s and 10 to 100 Mc/s, were studied. The output voltage developed across the limiter tank circuit, which will eventually drive an amplifier tube, is 160 V for the 2 Mc/s, 38 V for 20 Mc/s and 10.5 V for 100 Mc/s. Generation of high orders at high frequencies is progressivley difficult, as also happens with sine wave drive. Theoretical analysis of the multiplier circuit, using the Laplace transform method, explained the amplitude fluctuation, established the optimum conditions and predicted the amplitude variation with harmonic order and tank circuit characteristics. Author

N66-38977# System Development Corp., Santa Monica, Calif.
ONE-WAY STACK AUTOMATA Scientific Report No. 10
Seymour Ginsburg, Sheila A. Greibach (Harvard Univ., Cambridge, Mass.), and Michael A. Harrison (Calif. Univ., Berkeley) 22 Apr. 1966 61 p refs
(Contract AF 19(628)-5166)
(TM-738/025/00; AFCRL-66-398; AD-636032) CFSTI: HC $3.00/MF $0.75

A number of operations which either preserve sets accepted by one-way stack automata or preserve sets accepted by deterministic one-way stack automata are presented. For example, sequential transduction preserves the former; set complementation, the latter. Several solvability questions are also considered. Author (TAB)

N66-39003# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FORCED INSTRUCTION OF A PERCEPTION WITH THRESHOLD ELEMENTS
A. Z. Nepomnyashchiy and L. B. Nisnevich *In its* Sci. Tech. Inform. 21 Feb. 1966 p 22–35 refs (See N66-39001 24-34) CFSTI: HC $2.00/MF $0.50

Discussed are two instructional devices: an elementary perceptron, and a continuous perceptron with threshold-type elements for forced instruction. It is shown that the average reaction of the elementary perceptron to an appearing image depends only upon scalar reproduction of the recognized image on images of the instruction series. For the continuous perceptron the possibility is demonstrated to select a threshold from given compact, nonintersecting classes of images, with the perceptron thus performing the discrimination. Author

N66-39108# Joint Publications Research Service, Washington, D. C.
TECHNICAL CYBERNETICS, NO. 3, 1966
28 Sep. 1966 311 p refs Transl. into ENGLISH of Izv. Akad. Nauk SSSR, Tekhn. Kibernetika (Moscow), no. 3, May–Jun. 1966 p 1–192
(JPRS-37887; TT-66-34315) CFSTI: $6.00

Articles on system optimization and other aspects of theoretical and applied technical cybernetics are presented. For individual titles see N66-39109–N66-39136.

N66-39112# Joint Publications Research Service, Washington, D. C.
THE SOLUTION OF NONLINEAR CONVEX PROBLEMS OF MATHEMATICAL PROGRAMMING USING ELECTRONIC SIMULATORS
V. P. Lomakin, D. A. Kaminskaya, and V. A. Polyakov *In its* Tech. Cybernetics, No. 3, 1966 28 Sep. 1966 p 44–52 refs (See N66-39108 24-10) CFSTI: $6.00

A procedure is proposed for the solution of nonlinear convex problems (e.g., economic planning) of mathematical programming by using ordinary electronic simulators of series manufacture. This method is based on electronic simulation of the electrical analog circuit of the solved problem of mathematical programming. The problem solved is represented as a replacement diagram on the basis of which it is possible to construct an electrical analog curcuit of the problem. Dual circuits in the universal electronic simulators eliminate the need for setting up systems and controls for the electrical analog circuit. The nonlinear dependencies are reproduced by the corresponding functional convertor. The transport problem investigated is represented by an electrical direct current circuit consisting of diodes, and current and voltage sources, in which on a determinant scale the volumes of production and demand are represented by the sources and amount of current, and the cost, by the voltage sources. R.Li.

N66-39113# Joint Publications Research Service, Washington, D. C.
RANDOM SEARCH IN THE PRESENCE OF NOISE

L. S. Gurin *In its* Tech. Cybernetics, No. 3, 1966 28 Sep. 1966 p 53–65 refs (See N66-39108 24-10) CFSTI: $6.00

In relation to automatic optimization systems, the method of optimization of multiextremal functions is proposed with additive noise imposed on the functions. A generalization is made to the case of the presence of noise, and only convergence of the process is considered. Also investigated is one of the possible approaches to the solution of the problem of search for a global extremum of a function in the presence of noise. Proofs are given for the theorems advanced, and a formulation of the final results of convergence of the investigated process is stated. R.Ll.

N66-39114# Joint Publications Research Service, Washington, D. C.

A ONE-LINE SYSTEM WITH ERLANG DISTRIBUTION OF THE SERVICING TIME FOR REQUESTS OF DIFFERENT TYPES

G. P. Basharin *In its* Tech. Cybernetics, No. 3, 1966 28 Sep. 1966 p 66–77 refs (See N66-39108 24-10) CFSTI: $6.00

Analyzed is a one-line queueing system to which a multidimensional simplest flow of demands is addressed. The different types of demands show an Erlang distribution of the servicing time. The cases of a limited and an unlimited queue are investigated under the assumption that the discipline for selection of the requests from the queue does not give priority to any one of the flows. Recurrent flows formulas for calculating stationary probabilities are obtained which permit calculation of : the average length of the queue, the probability of idle time of the system, the probability of losses of requests, and other unsolved characteristics of the high-order system of equations of state. Stationary probabilities, and the derivative function of the queue length are found. It is shown that for certain fixed parameters, the average length of the number of requests in queue will be maximal when all the servicing times have exponential distribution; the average request length will be minimal when all servicing times are constant, and when the average length is two times less than in the former exponential-distributed case. R.Ll.

N66-39115# Joint Publications Research Service, Washington, D. C.

STATISTICAL SELECTION OF REQUESTS IN QUEUEING WITH A LIMITED LENGTH OF QUEUE

A. A. Natan *In its* Tech. Cybernetics, No. 3, 1966 28 Sep. 1966 p 78–82 ref (See N66-39108 24-10) CFSTI: $6.00

Considered are two classes of system inputs: the class of objects subject to servicing, and the class of objects not subject to servicing. Assuming that in the memory storage unit between the selection block and the servicing device a limited queue of information may be formed, the problem consists in finding the threshold value for which the probability of missing an object is minimized; that is, the probability that the object will not be serviced (as a result of not including it in the number of requests, or the busy state of the memory). A statistical selection method of preliminary thinning of the flow of requests arriving at a queueing system with refusals was investigated. This method is applied to queueing systems of a mixed type (a limited length of queue). A mathematical expression was formulated for finding the optimal region for which the probability of missing an object is minimal for the given capacity of the memory. R.Ll.

N66-39117# Joint Publications Research Service, Washington, D. C.

SEPARATION OF CLASSES OF OBJECTS OF AN AUTOMATIC SYSTEM WITH THE PARTICIPATION OF THE OPERATOR

I. N. El'ke, B. S. Pritsker, and Yu. S. Kotov *In its* Tech. Cybernetics, No. 3, 1966 28 Sep. 1966 p 99–105 refs (See N66-39108 24-10) CFSTI: $6.00

A procedure is investigated for separation of classes using the property of man to orient himself in two-or three-dimensional space. Arguments are presented with respect to selection of the transformation function of the n-dimensional signal and the memory size of the automaton. Author

N66-39118# Joint Publications Research Service, Washington, D. C.

OPTIMIZATION OF COMPLEX CHEMICAL PRODUCTION PROCESS SYSTEMS

G. M. Ostrovskiy *In its* Tech. Cybernetics, No. 3, 1966 28 Sep. 1966 p 106–118 refs (See N66-39108 24-10) CFSTI: $6.00

Investigated here are problems of using the methods of nonlinear programming for calculation of the optimal conditions of a number of typical chemical production process systems. It is demonstrated that the problem of optimization of series–parallel systems with feedback or without it may be solved by the methods discussed. Author

N66-39119# Joint Publications Research Service, Washington, D. C.

A PHYSICAL PRINCIPLE OF RELIABILITY THEORY

N. M. Sedyakin *In its* Tech. Cybernetics, No. 3, 1966 28 Sep. 1966 p 119–132 refs (See N66-39108 24-10) CFSTI: $6.00

In this work the physical principle (law) of reliability of material objects and systems is established on the basis of which the solution of a broad class of problems has become possible. It is shown that the results of this law are found in accord with the theoretical and experimental data. Author

N66-39120# Joint Publications Research Service, Washington, D. C.

SOME PROCEDURES FOR INCREASING THE EFFICIENCY OF INFORMATION PROCESSING SYSTEMS

A. V. Vershinskiy *In its* Tech. Cybernetics, No. 3, 1966 28 Sep. 1966 p 133–142 refs (See N66-39108 24-10) CFSTI: $6.00

The possibility of using the methods for testing statistical hypotheses for the detection of states of disrepair and increasing the efficiency of an instrument system is investigated. The initial information is obtained on the basis of smoothing and extrapolation of the controlled signals. Author

N66-39121# Joint Publications Research Service, Washington, D. C.

NONLOADED DOUBLING WHEN TAKING SWITCHING TIME INTO ACCOUNT

Akhmed Omar and Yusef Nasr *In its* Tech. Cybernetics, No. 3, 1966 28 Sep. 1966 p 143–147 refs (See N66-39108 24-10) CFSTI: $6.00

The results of the work by B. V. Gnedenko are generalized. The time required for switching the reserve device into the location which is out of order is studied. The distributions of the trouble-free operation time for the device, the switching time and the repair time are considered to be arbitrarily distributed random variables. The repair completely restores the properties of the device. Author

N66-39122# Joint Publications Research Service, Washington, D. C.

THE PROBLEM OF RELIABILITY OF SYSTEMS WITH MAJORITAL ELEMENTS

V. M. Ozernoy *In its* Tech. Cybernetics, No. 3, 1966 28 Sep. 1966 p 148–152 refs (See N66-39108 24-10) CFSTI: $6.00

To increase reliability of information processing systems, the probabilities of different causes for breakdowns in a system containing functional logical blocks and a repair organ are determined in the case where the operation of the system is described by a Markov chain with absorption. R.Ll.

N66-39124# Joint Publications Research Service, Washington, D. C.

DETERMINATION OF THE CHARACTERISTICS OF PROBABILITY AUTOMATA WITH FEEDBACK

V. I. Levin *In its* Tech. Cybernetics, No. 3, 1966 28 Sep. 1966 p 165–170 refs (See N66-39108 24-10) CFSTI: $6.00

Matrixes which completely characterize their operations are determined for probability automata containing feedback in the circuit. Partial matrixes are found for automaton transitions with m states containing feedback. A procedure is presented for finding matrixes of transitions and outputs, and it is considered also applicable when the memory part of the automaton consists of several stages. R.U.

N66-39125# Joint Publications Research Service, Washington, D. C.

ANALYSIS OF AUTOMATA USING COMPUTERS

Hugo Daniel Skol'nik *In its* Tech. Cybernetics, No. 3, 1966 28 Sep. 1966 p 171–174 refs (See N66-39108 24-10) CFSTI: $6.00

The known matrix algorithm is investigated which permits determination of the characteristic cycles, the minimal paths, etc. according to the matrix of transitions of the automata within states. Some difficulties are described which arise when using such an algorithm, and another algorithm is proposed which permits avoidance of these difficulties. This algorithm may be easily programmed using a computer where the machine time when using it is significantly reduced. With appropriate changes it may be used for the investigation of automata with a large number of states. Author

N66-39126# Joint Publications Research Service, Washington, D. C.

A PROCEDURE FOR GIVING AUTOMATA

Ye. N. Vavilov and L. P. Lobanov *In its* Tech. Cybernetics, No. 3, 1966 28 Sep. 1966 p 175–193 refs (See N66-39108 24-10) CFSTI: $6.00

A procedure is investigated for giving automata by systems of difference equations. The methods are presented for obtaining the dependency of the number of input words converting the automata into an arbitrary internal state (from the initial state), on the length of these words. A procedure is explained for finite automata to generate integral step functions. The statement of the problem of synthesis for the proposed procedure for giving automata is discussed. Author

N66-39129# Joint Publications Research Service, Washington, D. C.

OPTIMAL CONTROL OF A CONTROLLABLE MONOTONICALLY INCREASING RANDOM PROCESS

Ye. Yu. Barzilovich *In its* Tech. Cybernetics, No. 3, 1966 28 Sep. 1966 p 220–227 refs (See N66-39108 24-10) CFSTI: $6.00

The optimal control of a monotonically increasing random process is investigated. The random process is controllable, the control step is constant. The control of the process is realized with respect to a specific realization taking into account information about the state of the process at the control time. Both continuous and discrete random processes are investigated. The theory which forms the control basis is formulated. Author

N66-39130# Joint Publications Research Service, Washington, D. C.

THE INDIRECT METHOD FOR OBTAINING INADEQUATE INFORMATION ABOUT THE POSITION OF A CONTROLLABLE SYSTEM IN PHASE SPACE

M. A. Babikov and Yu. M.-L. Kostyukovskiy *In its* Tech. Cybernetics, No. 3, 1966 28 Sep. 1966 p 228–232 refs (See N66-39108 24-10) CFSTI: $6.00

The problem of indirect determination of deviations of the phase coordinates of the nonstationary controllable systems from the calculated trajectory is investigated. For the solution of the problem the variation approach is used. A simple computational procedure is developed. The phase coordinates of the controllable system are determined at discrete points in time. Author

N66-39131# Joint Publications Research Service, Washington, D. C.

THE OPTIMAL ALGORITHM FOR EXTREMAL CONTROL IN THE PRESENCE OF NOISE AT THE INPUT AND OUTPUT OF A SYSTEM

E. A. Mazgovaya *In its* Tech. Cybernetics, No. 3, 1966 28 Sep. 1966 p 233–238 ref (See N66-39108 24-10) CFSTI: $6.00

The problem of optimal tracking of the extremum is solved in the case of an inertialess object in the presence of noise at the input and output of the system. According to the method of dynamic programming a functional equation is constructed the solution of which is used for construction of the optimal control function. Author

N66-39132# Joint Publications Research Service, Washington, D. C.

SYNTHESIS OF INDIRECT-ACTION INFORMATION SYSTEMS

V. Ya. Rotach and M. B. Khadzhiyski *In its* Tech. Cybernetics, No. 3, 1966 28 Sep. 1966 p 239–248 ref (See N66-39108 24-10) CFSTI: $6.00

The problem of obtaining information about the measurement of the controlled coordinate of the object is investigated where the coordinate is inaccessible for direct control in the case where information is absent about the internal properties of the object and the disturbances which are acting on it. The conditions are obtained which must be satisfied by the probability characteristics of the control coordinate in order that this measurement be made accurately. Expressions are found for the transfer function of a computer which permits taking of measurements exactly or with minimum least square error. Author

N66-39133# Joint Publications Research Service, Washington, D. C.

STATISTICAL ANALYSIS OF SYSTEMS WITH AMBIGUOUS NONLINEARITIES

I. Ye. Kazakov *In its* Tech. Cybernetics, No. 3, 1966 28 Sep. 1966 p 249–259 refs (See N66-39108 24-10) CFSTI: $6.00

The method of statistical linearization of ambiguous nonlinearities is discussed on the basis of investigation of them as multidimensional inertialess functions of dependent variables. Examples are considered of analysis of closed systems with the use of the method developed. Author

N66-39134# Joint Publications Research Service, Washington, D. C.

SYNTHESIS OF OPTIMAL CONTROL FOR A SYSTEM OF SECOND ORDER WITH LIMITATIONS ON THE PHASE COORDINATES AND CONTROL

L. M. Koziorov and Yu. I. Kupervasser *In its* Tech. Cybernetics, No. 3, 1966 28 Sep. 1966 p 260–270 refs (See N66-39108 24-10) CFSTI: $6.00

The optimal control is determined which minimizes the quadratic functional for an object described by two sequential integrating links. The phase coordinates and control have restrictions imposed on them of the type of inequalities. By means of simulation the field of optimal controls is obtained. The expression is given which approximates the optimal control in the given region of the phase coordinates. Author

N66-39135# Joint Publications Research Service, Washington, D. C.

A METHOD FOR SYNTHESIS OF AUTOMATIC SYSTEMS WITH DIGITAL CORRECTION DEVICES

E. A. Kuz'min and N. Ya. Sitko *In its* Tech. Cybernetics, No. 3, 1966 28 Sep. 1966 p 271–286 refs (See N66-39108 24-10) CFSTI: $6.00

Consideration is given to the synthesis of a system with a continuous object, and an attempt to obtain the required quality of the continuous output process, which for linear systems is defined by the form of their frequency characteristics. A method is investigated for synthesis of automatic systems with digital correction devices on the basis of frequency characteristics. R.Li.

N66-39136# Joint Publications Research Service, Washington, D. C.

SYNTHESIS OF LINEAR STATIONARY SYSTEMS WITH A GIVEN ACCURACY OF CONVERSION OF USEFUL SIGNAL IN THE PRESENCE OF NOISE

B. Z. Sokolov *In its* Tech. Cybernetics, No. 3, 1966 28 Sep. 1966 p 287–292 refs (See N66-39108 24-10) CFSTI: $6.00

The pulse transfer function is found for a system which realizes with the required degree of accuracy and maximum high speed the given transformation of the regular and random components of useful signal in the presence of noise. Author

N66-39186# Joint Publications Research Service, Washington, D. C.

TWENTY-SECOND ALL-UNION SCIENTIFIC SESSION DEVOTED TO RADIO DAY. SECTION ON RADIO RECEIVERS AND AMPLIFIERS

9 Sep. 1966 157 p refs Transl. into ENGLISH of the publ. "XXII Vsesoyuznaya Nauchnaya Sessiya, Posvyashchennaya Dnyu Radio. Sektsiya Radiopriyemnykh Ustroystv i Ustiliteley" Moscow, 1966

(JPRS-37520; TT-66-33948) CFSTI: $4.00

Conference papers on radio frequency receivers, amplifiers, related electronics, and operating and design problems are presented. For individual titles see N66-39187–N66-39208.

N66-39193# Joint Publications Research Service, Washington, D. C.

A FREQUENCY PHASE AUTOTUNING SYSTEM WITH A SEPARATION CONDENSOR IN THE FEEDBACK LOOP

V. D. Shalfeyev *In its* Twenty-second All-Union Sci. Session devoted to Radio Day. Sect. on Radio Receivers and Amplifiers 9 Sep. 1966 p 32–38 refs (See N66-39186 24-10) CFSTI: $4.00

The differential equation of the frequency phase autotuning system with low and high frequency filters in the feedback loop is presented and discussed. The time constants, phase trajectories, and fast and slow motion along the trajectories are mentioned. It was concluded that in the system with a separation condensor in the feedback circuit, the condition of quasisynchronism corresponds to the slow motion of the image point during the time of a pulse in a sufficiently small vicinity of some residual detuning with respect to the frequency for a constant slow increase in the phase difference. N.E.N.

N66-39194# Joint Publications Research Service, Washington, D. C.

THE DYNAMICS OF A NONLINEAR SYSTEM FOR FREQUENCY-PHASE AUTOTUNING

L. N. Bellyustina and V. D. Shalfeyev *In its* Twenty-second All-Union Sci. Session devoted to Radio Day. Sect. on Radio Receivers and Amplifiers 9 Sep. 1966 p 39–45 refs (See N66-39186 24-10) CFSTI: $4.00

The dynamics of a frequency phase autotuning device, for increasing noise resistance of the system while maintaining a large trapping band, are investigated. It is concluded that there is a possibility of generation and existence of the limiting cycles, and that the trapping band of most interest will be defined by the bifurcation of the saddle separatrices. Calculations show that there is an increase in the trapping band with the device. N.E.N.

N66-39195# Joint Publications Research Service, Washington, D. C.

ACCURACY OF FREQUENCY PHASE AUTOTUNING WITH RANDOM DISTURBANCES

Yu. F. Ignatov *In its* Twenty-second All-Union Sci. Session devoted to Radio Day. Sect. on Radio Receivers and Amplifiers 9 Sep. 1966 p 46–49 refs (See N66-39186 24-10) CFSTI: $4.00

A multidimensional Fokker-Planck equation is obtained for the density distribution of the coordinates of the system and the Gaussian approximation; equations are found for the numerical parameters of distribution. On the basis of the Gaussian approximation, the distribution of the phase error is made more exact, the lack of variation in the form of the distribution is established from the order of the system and the type of filter. Author

N66-39202# Joint Publications Research Service, Washington, D. C.

THE DESIGN OF AMPLIFIERS WITH DEEP NEGATIVE FEEDBACK WITH RESPECT TO JOINTLY GIVEN PARAMETERS OF THE TRANSFER AND FREQUENCY CHARACTERISTICS

M. S. Shmilevich *In its* Twenty-second All-Union Sci. Session devoted to Radio Day. Sect. on Radio Receivers and Amplifiers 9 Sep. 1966 p 92–96 refs (See N66-39186 24-10) CFSTI: $4.00

Various methods of designing amplifiers with deep negative feedback, in relation to the requirements imposed on their transfer characteristics, are discussed and their limitations and disadvantages are pointed out. A design method taking frequency and transfer characteristics into consideration is described. Approximate dependencies were obtained by relating the magnitude of the stability reserve with respect to the phase of the amplifier. Equations were formulated for the predominant poles of the transfer function, and approximate equations were derived for which the concept of predominant poles is applicable. L.E.W.

N66-39203# Joint Publications Research Service, Washington, D. C.

PROCEDURES FOR CONSTRUCTING LOGARITHMIC VIDEO AMPLIFIERS WITH A STABLE PASS BAND

G. M. Krylov and V. I. Panov *In its* Twenty-second All-Union Sci. Session devoted to Radio Day. Sect. on Radio Receivers and Amplifiers 9 Sep. 1966 p 97–100 (See N66-39186 24-10) CFSTI: $4.00

The advantages and disadvantages of three procedures for stabilizing the width of the passband are assessed. These are identified as (1) the introduction into the logarithmic circuits of linear resistances which shunt the nonlinear elements and weaken their influence; (2) the construction of intercascade communications in the form of more or less complex circuits described by differential equations of the fourth and higher order; and (3) the introduction of band filters or amplification cascades into the amplifier to shape the frequency characteristic in advance. The first procedure is not recommended as a basic one, since the constant component of the active load resistance increases and the effect of the variable component on the input signals is weakened. The basic disadvantage of the second method is cited as increased complexity of tuning. From the structural and technological viewpoint, the third procedure is considered the simplest since it offers the possibility of indentically constructing all the cascades which, to a significant extent, can eliminate tuning difficulties. M.G.J.

N66-39296# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

POLYTECHNIC INSTITUTE, SCIENTIFIC PAPERS, AUTOMATION Selected Articles

9 May 1966 39 p refs Transl. into ENGLISH from Yeszyty Nauk. Politech. Wroclaw., Automatyka (Poland), no. 85, 1964 p 43–60, 77–85
(FTD-TT-65-1089; TT-66-62038; AD-637065) CFSTI: HC $2.00/MF $0.50

CONTENTS:

1. POSSIBILITIES OF APPLYING INFORMATION THEORY TO TELEMETRY T. Balchan p 1–20 refs (See N66-39297 24-07)

2. SYNTHESIS OF LOGIC NETWORKS CONTAINING DYNAMIC TRIGGERS W. Komorowski p 21–31 refs (See N66-39298 24-10)

N66-39298# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SYNTHESIS OF LOGIC NETWORKS CONTAINING DYNAMIC TRIGGERS
Witold Komorowski *In its* Polytech. Inst., Sci. Papers, Automation 9 May 1966 p 21–31 refs (See N66-39296 24-10) CFSTI: HC $2.00/MF $0.50

This paper presents an analytical method of synthesizing logic networks on the basis of the state table. The network discussed is a synchronized network and consists of dynamic triggers, OR and AND gates, and correcting delay elements. Examples of designing such networks are given and the functional analysis of the results obtained is made. Author

N66-39461# Sperry Rand Corp., Blue Bell, Pa. UNIVAC Engineering Center.
SYNTHESIS OF LOGIC FUNCTIONS ON AN ARRAY OF INTEGRATED CIRCUITS Final Report, 1 Nov. 1964–31 Oct. 1965
Lester M. Spandorfer 30 Nov. 1965 95 p refs
(Contract AF 19(628)-2907)
(AFCRL-66-298; AD-637174) CFSTI: HC $3.00/MF $0.75

This report summarizes the results of a study on the utilization of arrays of logic cells to provide any desired switching function. Each logic cell can be connected to other cells in the array by means of simple, preplanned interconnection patterns. The work of the past year has been devoted mainly to the problem of utilizing faulty arrays in an economical manner and to the problem of improving the connectivity in the array by means of increasingly complex patterns. The study of faulty arrays has been divided into three areas: error-correction codes uded to compensate for faulty cells in memory-type arrays; bit-skewing and autonomous register compacting techniques which permit the use of simple wiring patterns on a faulty array; and fault avoidance by means of computer-determined stretching actions on the fault-free wiring pattern which preserve the original wiring topology and do not introduce new crossovers. The notion of a control array superimposed on a logic array is introduced as a method of achieving a programmable array; the control array is used to specify the logic function of each cell and its connectivity in the overall logic array. The study of improved connectivity introduced two interconnection patterns which have been investigated elsewhere for use in telephone switching and in macrocellular arrays, namely Clos three-stage networks and Elspas n(d,k) graphs, respectively Author (TAB)

N66-39463# IIT Research Inst., Chicago, Ill. Technology Center.
BIBLIOGRAPHY, OPTIMUM MECHANICAL DESIGN SYNTHESIS, VOLUME II Final Report
W. D. Pilkey Jun. 1966 1238 p refs
(Contract DA-31-124-ARO(D)-243)
(AROD-4957-6; M6089; AD-637595) CFSTI: HC $21.38/MF $5.25

Optimum mechanical design synthesis: Bibliography. TAB

N66-39648# Illinois Univ., Urbana. Coordinated Science Lab.
A STUDY OF HAZARDS IN TERNARY SWITCHING CIRCUITS
Louis Abecassis Aug. 1966 47 p refs
(Contract DA-28-043-AMC-00073(E); Grant AF-AFOSR-931-66)
(R-310; AD-637568) CFSTI: HC $2.00/MF $0.50

Ternary combinational switching networks consisting of elements which are similar to familiar binary switching elements are studied by means of a ternary switching albegra. Simplification procedures using map methods are presented. Static and dynamic hazards, and methods to eliminate them, are investigated. It is found that some ternary switching functions have unavoidable dynamic hazards. However, the class of ternary switching functions for which all hazards can be eliminated is larger than the class of corresponding functions in the binary case. The hazard elimination method presented is based on the use of maps Author (TAB)

N66-39674# Applied Technology, Inc., Palo Alto, Calif.
APPLICATION OF COMPUTERS TO RF CIRCUIT DESIGN Final Report, Jun. 1965–Jun. 1966
Sidney C. Chao Ft. Monmouth, N. J., Army Electron. Command [1966] 133 p refs
(Contract DA-28-043-AMC-01347(E))
(ECOM-01347-F; AD-637600) CFSTI: HC $4.00/MF $1.00

This is the final report for a one-year study program on the application of digital computer techniques for RF amplifiers. In this study, y-parameters of typical transistors are measured. Gain and input-output admittances are computed for iterative transmission, and a variable PI-network is used for high frequency compensation. Results of the study are provided by transistor curves, and in tabulated computer output. (Author) TAB

N66-39675# Chalmers Univ. of Technology, Goteborg (Sweden). Research Lab. of Electronics.
APPROXIMATE THEORY OF THE WIRE HELIX SLOW WAVE STRUCTURE Research Report No. 60
O. Nilsson 1 Apr. 1966 37 p refs *Its* Tech. Note no. 11
(Contract AF 61(052)-594)
(RADC-TR-66-549; AD-637785) CFSTI: HC $2.00/MF $0.50

The electromagnetic properties of the round wire helix slow wave structure are described by a generalized sheath helix theory, which makes it possible to predict the performance of practical TWTs quantitatively without introducing the concept of space harmonics. (Author) TAB

N66-39717*# Republic Aviation Corp., Farmingdale, N. Y.
BOOSTER ATTITUDE STABILIZATION NETWORK SYNTHESIS Summary Report No. 2
Nicholas C. Szuchy, Joseph J. Lane, and Judith C. Johnson 9 Jan. 1964 120 p refs
(Contract NAS8-5016)
(NASA-CR-78853; RAC-373-2) CFSTI: HC $4.00/MF $1.00 CSCL 09C

A technique was investigated for synthesizing networks with resistive loads resulting in normalized element values that have voltage transfer functions meeting the gain phase compensation requirements set by NASA. By minimization of the least squared error function using an iterative process such as the "tangent descent to a minimum" for a desk calculator, or the "gradient technique" for a digital computer, the normalized element values can be determined. The concept of synthesizing networks from topological considerations is developed. A quadratic lag function is considered; a comparison is made between the classical synthesis technique and the one considered in this report. By considering topological configurations of interest, the mathematical process yields less complex networks and non-ideal passive elements than those determined by classical synthesis techniques. Recommendations are made for a digital computer program that should be written for 1) defining the objective function to include

various network topologies of interest and 2) mechanizing the interative process used to determine the component values. Author

N66-39718*# Republic Aviation Corp., Farmingdale, N. Y.
BOOSTER ATTITUDE STABILIZATION NETWORK SYNTHESIS Summary Report
Nicholas C. Szuchy 25 Jan. 1963 84 p refs
(Contract NAS8-5016)
(NASA-CR-78858; RAC-373-1; SSD-802-901) CFSTI: HC $3.00/MF $0.75 CSCL 09C

The impedance synthesis techniques and transfer function factoring methods developed for realization of complex compensation networks for the Saturn booster are presented. Two major divisions—approximation and realization—result from the systematic approach to the synthesis of the shaping network meeting NASA requirements. Author

N66-39756# Illinois Univ., Chicago. Bioengineering Section.
EVOLUTIONARY PATTERN RECOGNITION SYSTEMS
A. H. Klopf 1 Nov. 1965 77 p refs
(Grant AF-AFOSR-978-65)
(AFOSR-66-1342; AD-637492) CFSTI: HC $3.00/MF $0.75

An adaptive network is proposed which is capable of self-organization on two levels: a fundamental level involving the structure of the system and a secondary level involving a set of variable weights within the structure. The system was simulated on a digital computer and its behavior investigated for the purpose of developing evolutionary processes by which systems could adapt structurally to their environment. The system was studied, first, as a non-evolutionary network; adaptation could occur only through variation of the weights. An empirical equation was established relating the structural parameters of this system to its capabilities. The evolutionary system, possessing the capability of structure modification, was then investigated. Several heuristics were developed which allowed the system to significantly improve its performance in a pattern recognition task through structure modification. Author (TAB)

N66-39778# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHOD OF OPTIMUM ENCODING OF INTERNAL STATES OF FINITE AUTOMATON
E. B. Yershov 13 Apr. 1966 29 p refs Transl. into ENGLISH from Probl. Peredachi. Inform. (Moscow), issue 17, 1964 p 17–70
(FTD-MT-65-237; TT-66-62095; AD-637417) CFSTI: HC $2.00/MF $0.50

Contents: Distinguishability of pseudoequivalent states; construction of basic and additional automatons; nonuniform encoding of internal states of finite automaton. TAB

N66-39851# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DIAMOND CIRCUIT CONSIDERATIONS
John D. Mc Carron 21 Jul. 1966 22 p ref *Its* Tech. Note 1966-39
(Contract AF 19(628)-5167)
(ESD-TR-66-396; AD-637166) CFSTI: HC $1.00/MF $0.50

The diamond circuit is a gated unity gain amplifier, the principal virtue of which is its extremely high input and output impedance in the Off state. The circuit has a wide variety of uses, but has several drawbacks which limit it at the present time to a few specialized functions. In space electronics, where power is very expensive, the use of diamonds in place of digital elements can provide large savings in power. Diamonds have been flown on several scientific spacecraft including the historic Mariner IV and the recent (16 December 1965) Pioneer VI, both of which are now orbiting the sun. Author (TAB)

N66-39897*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN ALGORITHM FOR SYNTHESIS OF ASYNCHRONOUS SEQUENTIAL CIRCUITS
John S. Tripp Washington, NASA, Nov. 1966 26 p refs
(NASA-TN-D-3273) CFSTI: HC $1.00/MF $0.50 CSCL 09C

An algorithm for synthesis of asynchronous sequential circuits is developed; this development is an extension of the well-known Boolean methods for synthesis of synchronous circuits. A matrix system of function representation is introduced and utilized in the execution of the algorithm. As an example, a six-count counter is synthesized with synchronous and asynchronous designs. Both designs are presented for comparison. Author

N66-39912*# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
CONTROL OPTIMIZATION, STABILIZATION AND COMPUTER ALGORITHMS FOR SPACE APPLICATIONS First Status Report, 1 Mar.–31 Aug. 1966
7 Oct. 1966 13 p refs
(Grant NGR-22-009-124)
(NASA-CR-79116; ESL-SR-285) CFSTI: HC $1.00/MF $0.50 CSCL 09C

Research focusing on the development of optimal and sub-optimal control systems, and nonlinear and time-varying systems, is outlined. Cited are published and continued studies on the development of computational algorithms for the solution of minimum fuel problems; the problem of computer storage requirements arising in the implementation of the linear and time-varying feedback system associated with the optimal control of a linear time-varying system with quadratic performance criteria; fundamental problems of control under uncertainty and the use of minimaxtype criteria of performance for their control; problems associated with the orbit transfer and rendezvous in circular orbits; and studies focusing on the development of ideas and concepts for the design of feedback control systems for high order nonlinear systems, with special emphasis on systems arising in the attitude control of space vehicles. Progress is reported in the following areas: (1) The use of Liapunov theory in the design of magnetic attitude control systems; (2) Stability and oscillations in nonlinear and time-varying feedback loops; (3) Stability in nonlinear discrete-time feedback systems and applications to the convergence of iterative procedures; and (4) A priori bounds on the solution of optimization problems. S.C.W.

N66-39915*# Brown Univ., Providence, R. I.
APPLICATIONS OF LIAPUNOV STABILITY THEORY TO CONTROL SYSTEMS
J. P. La Salle [1964] 17 p refs Repr. from Proc. IBM Sci. Computing Symp. on Control Theory and Appl., Yorktown Heights, N. Y., 19–21 Oct. 1964 p 61–75
(Grants NGR-40-002-015; AF-AFOSR-693-64; Contract DA-31-124-ARO(D)-270)
(NASA-CR-79119) CFSTI: HC $1.00/MF $0.50 CSCL 09C

Presented is a discussion of new applications of Liapunov's method for the study of stability, and a discussion of outstanding problems limiting the extension of the method. Cited are improved methods for analyzing the stability of nonautonomous systems, recent results on the stability of functional differential equations and stochastic differential equations which are of growing future importance, and inherent problems associated with the use of computers to generate Liapunov functions for a general class of systems. S.C.W.

N66-39916*# Denver Univ., Colo.
DEVELOPMENT OF THE CIRCUIT DESIGN FROM THE LOGIC DESIGN OF A RANDOM WALK MACHINE Final Report
William D. Lansdown Sep. 1966 49 p refs
(Grant NsG-518)
(NASA-CR-79120) CFSTI: HC $2.00/MF $0.50 CSCL 09C

The logic design of a small, high speed, random walk machine to solve Laplace's equation is described. To convert the logic diagrams to circuit diagrams, a commercial circuit family is chosen to implement the logic. The basis of choice of a circuit family is a figure of merit, f=C D, where C is the initial cost of the logic units and D is the propagation delay through a shift register bit, a frequently used element in the machine. The minimum value of f is the most desirable value. The circuit diagrams were then developed from the logic diagrams on the basis of the circuit family chosen. A control procedure is outlined in consideration of the computer to be used with the proposed random walk machine. The computer is found to be fast enough to control the random walk machine at the speed goals set for the random walk machine. Estimated costs based upon the number and cost of the logic units required is given. Proposals submitted and to be submitted are discussed. The appendix contains the circuit diagrams developed for the Random Walk machine along with the original logic diagrams. Author

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N66-39168# California Univ., Davis.
SITE DESCRIPTION AND DATA MANAGEMENT, APPENDIX B
Frank V. Jones, Donald L. Morgan, and Dennis A. Orr *In its* Invest. of Energy, Momentum and Mass Transfer Near the Ground Jun. 1966 p 205-224 refs (See N66-39148 24-20) CFSTI: HC $6.00/MF $1.50

Surface descriptions are presented for 3 years showing cropping patterns and cultural practices within a large area surrounding the experimental site. A series of maps are given which serve to locate the site with reference to its geographic and topographic orientation, and several changes and additions that have been made are listed. Examples of the various management forms such as the run log, instrumentation location and description form, scan schedule, and field check list are also shown which relate to data and transducers in the field. A.G.O.

N66-39603# General Electric Co., Schenectady, N. Y.
TEST AND EVALUATION OF THE LIMITED-MOTION PEDIPULATOR Final Report, 8 Apr. 1965-28 Feb. 1966
R. S. Mosher, J. S. Fleszar, and P. F. Croshaw Feb. 1966 61 p
(Contract DA-36-034-AMC-0268(T))
(AD-637681) CFSTI: HC $3.00/MF $0.75

The report is a description of the test and evaluation of a full-scale, limited-motion pedipulator. The investigation determined the impact of important variables that affect operator performance and directly influence the design of functional walking levered vehicles. Results indicated: (1) operators were able to quickly and accurately position and balance the machine; (2) operators retentions of learning were nearly perfect; and (3) machine-control response and other characteristics may be optimized in the design of walking levered vehicles Author (TAB)

N66-39626# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
WATER PRODUCTION IN A POLAR ICE CAP BY UTILIZATION OF WASTE ENGINE HEAT
Frank L. Russell Dec. 1965 22 p refs
(CRREL-TR-168; AD-632050) CFSTI: HC $1.00/MF $0.50

The results are discussed of the useful reclamation of heat from engine exhaust gas and coolant, which is normally rejected into the atmosphere and wasted, for the production of domestic water and for space and water heating. During the period of occupancy of the Tuto ice tunnel and under-ice camp (Greenland), domestic water was produced and stored in a subterranean reservoir beneath the floor of a cross-drift in the ice 40 ft from the Northeast wall of the power-plant building. Energy to produce water by melting the reservoir perimeter was supplied by rejected heat from one of two D 13,000 Caterpillar diesel engines driving a 75-kw 120/240-v generator which supplied camp electrical requirements. The power supply and heat exchange system are described.
Author (TAB)

N66-39736# ARO, Inc., Arnold Air Force Station, Tenn.
INVESTIGATION OF SCAVENGING SYSTEMS FOR REMOVAL OF ROCKET EXHAUST GASES FROM SPACE SIMULATION CHAMBERS Technical Report, Nov. 1964-Oct. 1965
J. A. Morris and D. E. Anderson Arnold Eng. Develop. Center, Aug. 1966 52 p refs
(Contract AF 40(600)-1200)
(AEDC-TR-66-108; AD-637702) CFSTI: HC $3.00/MF $0.50

Tests were conducted on a rocket exhaust scavenging system as part of a program to develop new techniques for testing at simulated space conditions. Detailed plume characteristics were computed, and a model scavenging system was tested for both cold and hot gas rockets. Results indicate that for the firing of a typical small control rocket it will be possible to maintain 0.0001 torr pressure in a space chamber Author (TAB)

N66-39843# Royal Aircraft Establishment, Farnborough (England).
A SUMMARY OF SOME DIGITAL SIMULATIONS RELATING TO RUNWAY UTILISATION
M. R. Abbott Mar. 1966 24 p refs
(RAE-TR-66087) CFSTI: HC $1.00/MF $0.50

This report describes some idealised digital simulation models of runway utilisation, which have been studied over the past few years. A model is described first which demonstrates the benefit of a regular schedule under steady conditions, even with considerable unpunctuality. An extension of this is then described with a time-dependent arrival rate; two alternative queue disciplines are considered and two types of traffic schedule. The queue performance is obtained in each case for different values of traffic intensity and for different values of a parameter representing the quality of schedule-keeping. A brief description is given of the Atlas program written for these simulations. Author

N66-39864# Midwest Research Inst., Kansas City, Mo.
AN ELECTRIC DEFLECTION MOLECULAR BEAM APPARATUS WITH A MASS SPECTROMETRIC DETECTOR Final Technical Report
Frank T. Greene and Thomas A. Milne Jul. 1966 20 p refs
(Contracts AF 49(638)-1568; AF 49(638)-1724)
(AFOSR-66-1716; AD-637176) CFSTI: HC $1.00/MF $0.50

A molecular beam apparatus for the measurement of dipole moments and polarizabilities by the electric deflection method was designed and is now essentially complete. A quadrupole mass filter is used as a detector. The system is completely bakeable to 400°C and uses modulated beam techniques for improved signal-to-noise ratios Author (TAB)

N66-39968*# General Electric Co., Syracuse, N. Y. Electronics Lab.
MODIFICATIONS TO INTERIM VISUAL SPACECRAFT SIMULATOR Sixth Quarterly Progress Report, 12 Apr.-12 Jul. 1966
[1966] 10 p
(Contract NAS9-3916)
(NASA-CR-65547) CFSTI: HC $1.00/MF $0.50 CSCL 14B

Effort has continued in the organization, logical design, and packaging design of the specific units. In addition, the evaluation

of prototype hardware has commenced, and the significant demonstration of a static tetrahedron, generated by prototype hardware, has occurred. A major procurement item, the Raytheon 520 computer, has been selected, ordered, received, and installed. Author

N66-39972*# Hughes Research Labs., Malibu, Calif.
MODIFICATION OF GOVERNMENT-OWNED THRUST STAND SYSTEM
J. D. Smith Aug. 1966 82 p
(Contract NAS3-7925)
(NASA-CR-72021) CFSTI: HC $2.50/MF $0.75 CSCL 14B

Purpose of the modification was to extend the upper range of the thrust stand system to 10 lbs and to improve the electrical subsystems. A system analysis is presented, and detailed descriptions and data are given for console control and instrumentation. In tests the system was run closed loop with a static load of 12 lbs for several minutes to cause deliberate over-heating of the voice coil and to demonstrate the over-temperature alarm circuitry. As a result of the overloading, audio and visual alarms were activated followed by automatic system shutdown. Primary design features of the equipment are fast response and isolation from background vibration. K.W.

N66-39980*# National Aeronautics and Space Administration, Washington, D. C.
GEOGRAPHIC COORDINATES OF ESRO AND CNES STATIONS
R. Fraysse Jun. 1965 4 p Transl. into ENGLISH of the Book "Coordonnees Geographiques des Stations ESRO et CNES" European Space Technol. Center, Mem. Stn./707, Append. 1, 18 May 1965
(NASA-TT-F-9415) CSCL 14B

The exact proper names, map references, altitudes, and sources of information are given in addition to the geographic coordinates for the nine tracking stations. K.W.

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N66-38863*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
NONISENTROPIC NONSTEADY LIQUID FLOW WITH CENTRIFUGAL, GRAVITATIONAL, AND DISSIPATIVE FORCES
Fred S. Sidransky Washington, NASA, Oct. 1966 15 p refs
(NASA-TM-X-1303) CFSTI: HC $1.00/MF $0.50 CSCL 20D

The method of characteristics is used to present general compatibility relations for nonsteady liquid flow or water-hammer theory which permit the investigation of the dynamics of the flow under diverse conditions; that is, for a liquid flowing in a variable area conduit affected by heat addition, by gravity, by friction forces, and by centrifugal forces such as in a mixed-flow radial vane pump. The compatibility equations are presented in finite difference form, and numerical-graphical methods for their solution are indicated. Author

N66-38975*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
THE LITERATURE OF LOW G PROPELLANT BEHAVIOR
G. A. Hastings, D. W. Hill, H. M. Satterlee, and J. G. Seebold 27 Sep. 1966 43 p refs
(Contract NAS9-5174)
(NASA-CR-65539; LMSC-A835805) CFSTI: HC $2.00/MF $0.50 CSCL 20D

Comments are made on 200 references to publications in the fields of low-g fluid mechanics and heat transfer which appeared during and after 1959. Major emphasis is given to the development of the theory of capillary fluid mechanics, and references which provide details regarding the results and history of development of this theory are identified. The publications selected in this bibliography are presented because of their practical importance to spacecraft designers, or because they were fundamental in the development of modern capillary fluid mechanics. The commentary is divided into seven sections dealing with propellant location and interface shape, interface stability, reorientation, sloshing, propellant containment and ullage control, draining, and heat transfer. Additional related topics are covered, and experimental techniques are discussed in the majority of the experimental investigations mentioned in the commentary. The bibliographic citations are grouped by calendar year, and listed alphabetically. H.S.W.

N66-39073# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TENSOR OF VISCOUS STRESSES AND THERMAL FLUX IN A TWO-TEMPERATURE PARTIALLY IONIZED GAS
M. Ya. Aliyevskiy, V. M. Zhdanov, and V. A. Polyanskiy *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 55–72 refs (See N66-39068 24-23) CFSTI: HC $7.00/MF $1.75

The starting point is linear algebraic equations for separate components, following from the general system of transport equations. Coefficients of the obtained expressions are simplified for the particular case of a three-component partially ionized gas with temperature of electrons, differing from the temperature of ions and atoms. There are given detailed expressions for coefficients of viscosity and thermal conductivity of such a two-temperature gas in a magnetic field. There is calculated the contribution of each of the components to the total tensor of viscous stresses and the thermal flux (including heat transfer by diffusion) depending upon the degree of ionization, strength of the magnetic field, and the degree of nonisothermalness of the plasma. Author

N66-39079# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MEASUREMENT OF PARAMETERS OF GAS FLUXES WITH THE HELP OF A BEAM OF FAST ELECTRONS
A. M. Trokhan *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 134–157 refs (See N66-39068 24-23) CFSTI: HC $7.00/MF $1.75

Various methods of measuring such parameters as local velocity and density of gas of fast fluxes are assessed, with attention focused on the use of a thin beam of fast electrons as a probe for such determinations. Consideration is given to the excitation of fluorescence of gas, fluorescent tracing, fluorescent blow-away, luminescent probes, and Doppler shift of spectral lines. The possibility of using X-radiation for determining the local density of gas emitted during the slowing-down of fast electrons is also examined. Flow visualization techniques using fast electron beams are discussed, and it is pointed out that the method used is dependent on the duration of the afterflow. M.G.J.

N66-39080# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DETERMINING DENSITY FIELDS OF THREE-DIMENSIONAL GAS-DYNAMIC FLOWS ON THE BASIS OF OPTICAL METHODS
S. M. Belotserkovskiy, V. S. Sukhorukikh, and V. S. Tatarenchik *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 158–166 refs (See N66-39068 24-23) CFSTI: HC $7.00/MF $1.75

Approximating functions are selected to describe the density fields, and the form of the surface discontinuity. These functions

are determined from interference or shadow measurement results obtained for different directions of light ray movements through the gas flux. The necessary quantity of directions is dependent on the form of the investigated flow and is established during the research process. Author

N66-39081# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON MECHANISMS OF DISINTEGRATION OF A DROP MOVING IN A GAS FLOW

V. A. Borodin, Yu. F. Dityakin, and V. I. Yagodkin *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 167–174 refs (See N66-39068 24-23) CFSTI: HC $7.00/MF $1.75

Different forms of perturbations, appearing during motion of a fluid spherical drop in a medium of another fluid, are examined. The critical values of the Weber number were found, along with forms of neutral perturbations. The case of increasing perturbations, and their form for different values of the Weber number, is considered. Findings indicate that oscillation and breaking phenomena in part of a fluid torus play an essential role in drop disintegration. M.G.J.

N66-39082# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INFLUENCE OF THE RELATIVE VELOCITY OF A GAS BUBBLE IN A LIQUID ON CHANGE OF ITS DIMENSIONS

Yu. N. Kalashnikov *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 167–174 refs (See N66-39068 24-23) CFSTI: HC $7.00/MF $1.75

Equations of state are derived for a gas bubble moving in liquid, with gas diffusion taken into account. For comparison, experimental research was also conducted to determine the influence of the relative velocity of the bubble in a liquid on the change in its dimensions. Observations show that the intensity of gas diffusion into a gas bubble during its relative motion in a liquid increases proportionally to the velocity of flow past the bubble to the 1/2 power. Even with sufficiently small relative velocities, diffusion intensity is increased by an order or more as compared to the case of a motionless bubble. It was found that the experimental research results confirmed the theoretical conclusions. M.G.J.

N66-39083# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON THE STABILITY OF A COLLAPSING GAS CAVITY IN ROTATING LIQUID

V. K. Kedrinskiy and G. M. Pigolkin *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 189–195 (See N66-39068 24-23) CFSTI: HC $7.00/MF $1.75

This work, basically, is devoted to experimental research on the stability of the shape of a collapsing gas cavity, formed by a rotating liquid volume and filled with air or a mixture of acetylene and oxygen. In the latter case we determined the influence of ignition of the mixture at the moment of maximum compression on stability of the cavity shape during its subsequent expansion. Diagrams of the observed phenomena are constructed. Author

N66-39090# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EXPLOSION ON THE SURFACE OF A LIQUID

V. F. Minin *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 275–281 ref (See N66-39068 24-23) CFSTI: HC $7.00/MF $1.75

The problem of the motion of an ideal incompressible and weightless liquid of infinite depth, due to an explosion on its surface, is examined for the case where the momentum acquired by the liquid is taken as the basic parameter to characterize the effect of the explosion. The question is considered of whether, during self-simulation motion, the graph of the time-dependence of the size of the funnel, built in logarithmic scale, for a cylindrical explosion should be a straight line with angular slope equal to 1/3. Experimental research on producing cylindrical explosions are described, and the data are analyzed. Point explosion on a water surface is also discussed. Based on the results, it is concluded that motion of a weightless liquid, caused by a surface explosion, is close to self-simulating with an index $\alpha = 0.47$ for a cylindrical explosion, and $\alpha = 0.38$ for a point explosion. It was found that the experimental law of motion of a funnel does not correspond to the motion of weightless liquid. M.G.J.

N66-39091# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

REMARK ON SCATTERING OF A GAS CLOUD IN A VACUUM

Yu. P. Rayzer *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 282–287 refs (See N66-39068 24-23) CFSTI: HC $7.00/MF $1.75

The concept that particles of gas have a Maxwellian velocity distribution in spherically symmetric free-molecular scattering is questioned on the basis that very special initial conditions are needed, which are almost unrealizable in practice. The point is made that the most important object for applying the idealized problem of scattering of a gas sphere into a vacuum is the process caused by an explosion-like heating and transformation into gas of a certain quantity of solid matter in a rarefied medium. It is admitted that in many practical cases the density profile, formed in the stage when forces of pressure still act, has features in common with the Gaussian curve, and the final velocity distribution has common features with the Maxwellian. However, this is viewed as a convenient approximation having no physical connection with the initial Maxwellian distribution of heated gas. M.G.J.

N66-39092# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EQUATIONS OF STEADY AXISYMMETRIC FLOWS OF GAS IN VARIABLES "PRESSURE-STREAM FUNCTION"

V. G. Dulov *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 288–295 ref (See N66-39068 24-23) CFSTI: HC $7.00/MF $1.75

Examples are given to show how equations of steady axisymmetric flows of an inviscid and non-heat conducting gas with an arbitrary equation of state are converted to a form in which pressure and the stream function are considered as independent variables. The function of these variables is introduced so that dynamic equations are satisfied identically; from the continuity equation for this function, the Monge-Ampere equation is obtained. The function constitutes a flow of momentum through a line of constant pressure in the direction of the axis of symmetry. Through values of this function, a simple expression is formulated for the drag coefficient of a solid of revolution with a generatrix in the form of an arbitrarily taken flow line. Two cases are considered. For external flow by supersonic flow past a body with an arbitrary generatrix, the change of function along an isobar is approximated by a polynomial from the stream function which reduces the problem to a system of differential equations. In the second problem, the distribution of parameters between the shock wave and the surface of a blunt body in a hypersonic flow is approximated. M.G.J.

N66-39094# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

APPROXIMATE METHOD OF CALCULATION OF OPTIMUM SUCTION OF FLUID FROM THE BOUNDARY LAYER OF WING PROFILES WITH A POROUS SURFACE

L. F. Kozlov. *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 302–307 refs (See N66-39068 24-23) CFSTI: HC $7.00/MF $1.75

In the proposed method, the equation of zero moment is converted to linear form, using approximate interpolation formulas for the coefficient of friction and shape parameter H. Calculations of optimum suction of fluid from the boundary layer start from the Reynolds number value R^{**}_0 at the point of loss of stability of the layer. For known velocity distribution on the external boundary of the layer of a wing profile U(x) and given values of H, R^{**} is calculated. The relationship $R^{**}_0(x)$ is graphically determined by obtaining curves $R^{**}(x,H)$ and using local critical Reynolds numbers. The method of small disturbances of hydrodynamic stability of liquid flow in a laminar boundary layer is used to calculate the lower values of the local critical Reynolds number R^{**}_0. An approximate formula is derived to determine values of $R^{**}_0(H)$. A formula is then found for the optimum distribution along a chord of a wing profile of the velocity of fluid suction from the boundary layer. For the particular case of a porous plate, expressions are reduced to an integral exponential function. M.G.J.

N66-39336# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

VISCOUS-PLASTIC FLOW OF CIRCULAR DISKS AND CASES OF ROTATION

G. I. Bykovtsev and T. D. Semykina. *In its* News of the Acad. of Sci. and of the USSR. Mech. and Maching Building 21 Feb. 1966 p 11–28 refs (See N66-39334 24-32) CFSTI: HC $3.00/MF $0.50

The behavior of viscous-plastic cases of rotation is discussed for initial conditions of Tresk's plasticity; the connection between the stress tensor and the speed of deformation for viscous-plastic media was formed by analogy with the theory of flow of hardening plastic material. Relationships are given that determine the connection between the speeds of deformation and stresses in a viscous-plastic body. Three combinations of the condition of plasticity are given, and relationships are constructed by analogy with the theory of an isotropic hardening plastic body and by modification of translational hardening. Behavior of viscous-plastic materials with plane tension state are considered, and the case of rotation under the action of an axisymmetrical load is examined. L.E.W.

N66-39338# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON THE SUPPORTING PROPERTIES OF A THIN LAYER OF GAS OR A CAVITATION LIQUID

S. I. Sergeyev. *In its* News of the Acad. of Sci. of the USSR. Mech and Machine Building 21 Feb. 1966 p 42–56 refs (See N66-39334 24-32) CFSTI: HC $3.00/MF $0.75

The problem of the motion of a gas in a thin layer between immobile bases and parallel to its shield moving along the normal to the base is discussed. The integral relationship connecting the thickness of the layer and its pressure is obtained. For a really thin layer, the value of the pressure is obtained during a given fluctuation of the shield and its motion is determined with a given load. Observations of the fluctuations of the shield above a thin layer of a cavitation liquid is described. The significant forces acting on the side of the cavitation liquid and supporting statistically the loaded shield are measured. Author

N66-39347# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CERTAIN PROBLEMS OF THE HYDRODYNAMICS OF RELAXING MEDIA

I. P. Stakhanov and Ye. V. Stupochenko. *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 1–35 refs (See N66-39346 24-23) CFSTI: HC $7.00/MF $1.50

An examination is presented of some general properties of the motion equations of thermodynamically nonequilibrium media, and the transition to "equilibrium" hydrodynamics in the limiting case of small relaxation times. Certain problems of the propagation of small disturbances in relaxing media are investigated in a linear approximation. C.T.C.

N66-39354# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

JOINT FLOW OF IDEAL FLUIDS OF VARIOUS DENSITIES IN THE THEORY OF FLOW PAST PERMEABLE SURFACES

M. V. Tret'yakov. *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 138–149 refs (See N66-39346 24-23) CFSTI: HC $7.00/MF $1.50

The formulation and solution are given of a boundary value problem which hydrodynamically represents the flow of a three-dimensional forward flux past a uniformly permeable layer. This solution shows how an ideal fluid of one density flows past a uniformly permeable surface of revolution, and emits an ideal fluid of a different density. These results can be used in problems involving uniform saturation of a fluid flux of one density by a fluid of another density, and in problems involving filtration of gas and liquid mixtures. C.T.C.

N66-39355# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SELF-SIMILAR PROBLEM OF CONVECTION DIFFUSION IN THE PRESENCE OF HETEROGENEOUS CHEMICAL REACTIONS WITH A MIXED KINETICS

A. M. Suponitskiy. *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 150–162 refs (See N66-39346 24-23) CFSTI: HC $7.00/MF $1.50

Results are presented of research conducted with self-similar problems of convection diffusion during heterogeneous chemical reactions with mixed kinetics. The problem is formulated by considering a laminar flux of a viscous incompressible fluid flowing past a body with a chemically active surface on which there occurs a heterogeneous chemical reaction. Emphasis is placed on calculating the rate of transfer of a substance during reactions on an infinite plate. C.T.C.

N66-39361# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

APPROXIMATE METHOD OF SOLUTION OF THE PROBLEM OF EXPLOSION IN CERTAIN IDEAL COMPRESSIBLE MEDIA

V. P. Karlikov, V. P. Korobeynikov, and Ye. V. Ryazanov. *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 217–222 refs (See N66-39346 24-23) CFSTI: HC $7.00/MF $1.50

Consideration is given to the experimental and theoretical solutions to problems of explosions in ideal media such as water and water-saturated soils. The method is based on previous cases in which it was found that compressibility considerably affects the fluid pressure only in a relatively narrow zone adjacent to the shock wave. The region of flow is assumed to be divided by a spherical surface: in the first region adjoining the blowhole the fluid is considered incompressible; and in the second region adjoining the shock wave, the fluid is considered compressible. C.T.C.

N66-39363# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SIMILARITY OF SHOCK WAVES DURING THE EXPLOSION OF SPHERICAL CHARGES IN WATER AND IN AIR

V. D. Khristoforov. *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 240–248 refs (See N66-39346 24-23) CFSTI: HC $7.00/MF $1.50

Results are presented of the determination of empirical similarity laws for explosions in water and air. The formulas given

follow from equations of hydrodynamics and are experimentally confirmed. Experimental data are analyzed by using dimensional theory methods, and graphs of the determined parameters are shown. A.G.O.

N66-39366# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE BREAKUP OF DROPS AND A FLUID STREAM BY AN AIR SHOCK WAVE
A. A. Buzukov *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 265–275 refs (See N66-39346 24-23) CFSTI: HC $7.00/MF $1.50

An experimental study is described of the supercritical disintegration of droplets and streams of water by an air shock wave. The qualitative picture of breakup was studied, and empirically verified formulas for breakup time are proposed. A value is also presented for the critical relationship between the governing parameters at which the supercritical mechanism of disintegration starts. The experimental setup is discussed, and atomization time calculations are shown. A.G.O.

N66-39387*# Pittsburgh Univ., Pa. Dept. of Civil Engineering.
A STOCHASTIC MODEL STUDY OF THE MOVEMENT OF SOLID PARTICLES
Chao-Lin Chiu and K. C. Chen 31 Aug. 1966 70 p refs
(Grant NsG-416)
(NASA-CR-78763; SRCC-32) CFSTI: HC $3.00/MF $0.75 CSCL 20D

The transport of suspended solid particles under the influence of secondary flow is studied by a random walk method for the case of a three dimensional convective flow field in a corner of a straight rectangular channel. The secondary flow is a circulary motion of the fluid around an axis parallel to the longitudinal axis of the channel; while the primary flow is a translation of the fluid parallel to the longitudinal axis of the channel. A stochastic model is constructed that represents the transport of the suspended solid particles in the secondary current of the straight, noncircular channel and the developed diffusion equation for suspended solid particles is solved by Monte Carlo method. It is found that the motion of a single diffusing particle represents a spiral form and that its transport pattern is influenced by the secondary flow. Diffusion of a cloud of solid particles emitted from a point source results in a particle distribution represented by an isopleth system similar to secondary flow cells. G.G.

N66-39451# Giannini Controls Corp., Malvern, Pa. Astromechanics Research Div.
ON MASS ENTRAINMENT BY JETS. PHASE I: PRELIMINARY INVESTIGATIONS
Esteban Martinez Washington, AF Office of Sci. Res., Jun. 1966 47 p refs
(Contract AF 49(638)-1459)
(AFOSR-66-0643; AD-637204) CFSTI: HC $2.00/MF $0.50

This report speculates on the nature of mass entrainment by free jets effluxing into a quiescent medium of equal density. The complex dynamic of the jet boundary at laminar Reynolds numbers is examined. Data has been obtained concerning the frequency of vortex shedding, vortex growth rates, and total roll-up angles. This data was obtained in a water table using pulsed hydrogen bubble generation. An estimate is made of the rate of mass entrained by the scooping-up of the surrounding fluid by the developing vortex structures. The effect of disturbances (sound waves) on the jet is discussed in the light of the evidence of substantial increase in the entrainment rate of an artificially excited jet. A reattaching jet experiment is proposed to measure the effect of sound on entrainment rates. Preliminary data is presented on the attachment point versus entrainment rate for a ventilated Coanda bubble at Reynolds nos. of 1060, 1380, 2790 Author (TAB)

N66-39485# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mechanics.
RECTILINEAR FLUID FLOW GENERATOR OF OSCILLATING TYPE
W. H. Hoppmann, II and E. Kiss Aug. 1966 21 p refs
(Contract Nonr-591(20))
(AD-637552) CFSTI: HC $1.00/MF $0.50

A rectilinear fluid flow generator of an oscillating type was developed for the purpose of studying the rheological properties and flow characteristics of both Newtonian and non-Newtonian liquids. It consists essentially of a long horizontally supported straight tube which can be filled with a liquid in which an equally long concentric cylinder can be oscillated axially in harmonic motion at a predetermined frequency and amplitude. The external tube is mounted on elastic supports of measurable stiffness so that its natural frequency of axial oscillation can be readily calculated. Also, the motion of the external tube and the resultant force acting on it are readily measurable at any time. The principle of the apparatus depends on the fact that the outside tube is moved only by the liquid which itself is caused to flow by the controlled oscillations of the inside tube. It is assumed, at least in principle, that if the motion of the outside tube is known for a given motion of the inside cylinder, the constitutive equations for the liquid can be determined, or conversely, if the constitutive equations are known, the motion of the outside tube can be calculated for a given motion of the driving inside cylinder. Author (TAB)

N66-39488# California Inst. of Tech., Pasadena. Graduate Aeronautical Labs.
LIQUID SLOSHING IN AN ELASTIC CONTAINER
Pin Tong Jun. 1966 173 p refs
(Grant AF-AFOSR-352-63)
(AFOSR-66-0943; AD-637233) CFSTI: HC $5.00/MF $1.00

The motion of a liquid in a flexible container is important for rocket structural dynamics. The purpose of the paper is to study the dynamic response of the liquid, the sloshing frequencies and the stability of the free surface of the liquid in an elastic container. The variational principle for the problem of an incompressible, inviscid fluid in an elastic container is presented by considering the pressure energy of the fluid, the surface energy, and the Lagrangian of the elastic thin shell. The corresponding linearized equations are studied in terms of eigenvalues and eigenfunctions. The effects of the gravitation, the surface tension, the rigidity of the container, the free surface contact angle and its dynamic variation, on the natural frequencies and the stability of the free surface are discussed. It is found that the flexibility of the container always lowers the natural frequencies and also induces a mean oscillatory motion of the liquid that creates an oscillatory force on the container in the vertical direction. The equilibrium contact angle and its dynamic variation have an important effect on the limit of stability. The motion of a liquid in a circular cylindrical container with a flat flexible bottom is worked out in detail analytically by means of eigenfunctions. Some results are presented graphically. A numerical scheme using finite elements method is developed for an arbitrary container. Methods for improving the solution systematically are indicated. Author (TAB)

N66-39504# Massachusetts Inst. of Tech., Cambridge. Aerophysics Lab.
NONEQUILIBRIUM FLOW FIELDS DUE TO SPATIAL PISTON MOTIONS Technical Report No. 131
Mark B. Sussman Jun. 1966 196 p refs
(Contract AF 49(638)-1621; Grant AF-AFOSR-641-64)
(AFOSR-66-1250; AD-637489) CFSTI: HC $5.00/MF $1.25

The inviscid flow resulting from imposing a prescribed piston motion on a gas field previously at rest is examined. The gas model is presumed to possess several energy modes, one of which requires a finite time to approach thermodynamic equilibrium. A unified treatment of planar, cylindrical, and spherical wave motions is formulated by assuming sufficient spatial symmetry to enable

description of the field through two independent variables—distance and time. Emphasis is placed on evaluating, quantitatively as well as well as qualitatively, the worth of a linearized analysis in predicting the nature of a nonequilibrium flow field. To this end, linear and nonlinear calculations are preformed separately and compared. Results indicate that whereas the linear model is successful in the prediction of streamwise events, care must be used in interpreting the predicated flow field normal to the stream. Physical reasons for this dichotomy are discussed. Comparison of the hypersonic flows computed here is made with a recent approximate analytic approach. Author (TAB)

N66-39567# Colorado State Univ., Fort Collins. Fluid Dynamics and Diffusion Lab.

SIMILARITY-LAW PROFILES IN THERMALLY STRATIFIED SHEAR FLOWS

H. Chuang and J. E. Cermak. Jul. 1966. 33 p. refs. Presented at the Intern. Symp. on Boundary Layers and Turbulence Including Geophys. Appl., Kyoto, 19–24 Sep. 1966

(Grant DA-AMC-28-043-65-G20)

(CER66-67-HC-JEC-4; AD-637701) CFSTI: HC $2.00/MF $0.50

Measured mean wind velocity and temperature profiles in the thermally stratified flow of a wind tunnel near the wall can be expressed in a log-plus-linear law which is also representative of the field data. Although both laboratory and field data show some scatter around the theoretical line, a similarity between the mean wind velocity and temperature profiles does seem to exist. The scatter can partially be attributed to the fact that in some cases the Monin-Obukhov length scale becomes comparable in magnitude to the height under consideration. This in turn breaks down the assumption that was made in order to obtain the law. Subsequently, log-plus-linear-plus-square profiles were tried and the results showed little improvement on the scatter. Free convection seems to prevail in some runs of both laboratory and field experiments. The transition from a forced convection to a free convection in the thermally stratified flow was shown to be gradual and occurred at a Richardson number in the same range as predicted. Both the laboratory and the field data for zeta < 0 were best represented by a universal function of the form F_5(zeta) where n = 3/2 Author (TAB)

N66-39572# Naval Ordnance Test Station, China Lake, Calif.

THE EFFECT OF HIGH-MOLECULAR-WEIGHT POLYMER ADDITIVES ON THE PERFORMANCE OF A CONICAL DIFFUSER

H. V. L. Patrick. Aug. 1966. 28 p. refs

(NOTS-TP-4154; AD-637305) CFSTI: HC $2.00/MF $0.50

Experiments were conducted to obtain and compare conical-diffuser performance information using plain tapwater and high-molecular-weight polymer solutions. The diffuser exhibited a transitory-type separation with plain water. Test results showed that diffuser performance increased by approximately 7 to 9 percent when using J2-FP guar gum solution concentrations of 1/64 to 1/8 percent over a Reynolds-number range of 55,000 to 75,000. The experiments also revealed that large-scale pressure fluctuations might be greatly decreased by the use of these solutions. (Author) TAB

N66-39634# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mechanics.

CONE ROTATING IN NEWTONIAN LIQUID WHICH HAS A FREE SURFACE

Y. K. Hsu and W. H. Hoppmann, II. Sep. 1966. 52 p. refs

(Contract Nonr-591(20))

(AD-637622) CFSTI: HC $3.00/MF $0.50

The study represents a cone, of a previously studied problem of the laminar flow induced in a Newtonian liquid by a rotating cone. Using flow visualization techniques and flow timing devices, velocity functions which very precisely define the actual flow were developed. The functions are such that the center line of the vortical motion is correctly located and the flow about it is accurately described. The velocity boundary conditions and the continuity equation are satisfied. The stress field in the liquid was determined from the velocity functions. Using these stress functions, an equation relating the total torque on the cone and its angular velocity was developed so that it agrees with experimental data. The nature of the pressure field is discussed in some detail. Also, with the aid of experimentally determined pressures and theoretically determined shearing stresses the total resultant thrust on the cone was calculated. This thrust was then compared with that measured with a special dynamometer. Author (TAB)

N66-39665# Giannini Controls Corp., Malvern, Pa. Astromechanics Research Div.

STUDIES IN SENSITIVE FLOW PHENOMENA USING MOMENTUM THEORY

Trevor D. Reader. Jun. 1966. 55 p. ref

(Contract AF 49(638)-1459)

(AFOSR-66-0652; AD-637194) CFSTI: HC $3.00/MF $0.50

The need for a basic understanding of sensitive flows in fluidics is stressed. A theory based on momentum exchange is applied to impinging wall jets. Comparison of results predicted by the theory with those obtained from water table tests shows good correlation. Areas of further study are suggested by the test results and a set of goals for fluidics is recommended. (Author) TAB

N66-39725*# Brown Engineering Co., Inc., Huntsville, Ala. Research Labs.

NONLINEAR FLUID OSCILLATIONS IN A PARTIALLY FILLED CYLINDRICAL SECTOR CONTAINER

James A. Baird, Jr. Aug. 1966. 88 p. refs

(Contract NAS8-20073)

(NASA-CR-78943; R-212) CFSTI: HC $3.00/MF $0.75 CSCL 20D

This investigation is a study of finite–amplitude free oscillations of an inviscid incompressible fluid in a cylindrical sector container. The analysis is made for a standing wave whose motion to the first approximation is that of the first nonaxisymmetric mode. The effects of surface tension are not considered. The method of Krylov and Bogoliubov is used to satisfy the nonlinear boundary condition. Numerical results are presented for 90° sector tanks. Author

N66-39735# Mitsubishi Heavy-Industries, Ltd., Nagasaki (Japan). Experimental Tank Lab.

INVESTIGATION INTO THE PROPELLER CAVITATION IN OBLIQUE FLOW

Kaname Taniguchi, Hidetake Tanibayashi, and Noritane Chiba. May 1966. 57 p. refs *Its* Rept.-2

(Contract Nonr-5002(00))

(Rept.-2221; AD-637549) CFSTI: HC $3.00/MF $0.50

In the previous study on the propeller cavitation in oblique flow, it was noticed that the thrust and the torque measured in tunnel decreased with shaft inclination, contrary to the results of a theoretical calculation. In the present study, therefore, the cause of the discrepancy between the theory and the experiments was investigated first, and it was found that the decrease of the measured thrust and torque in oblique flow was due to the rotational wake of the rotating propeller shaft upstream of the propeller. Then, cavitation tests in oblique flow condition were carried out on the series of supercavitating propellers to see the effects of pitch ratio and expanded area ratio on the cavitation characteristics in oblique flow condition, as planned originally. The results were presented with the correction for the rotational wake. Author (TAB)

N66-39737# Case Inst. of Tech., Pittsburgh, Pa. Engineering Div.

LIQUID GAS CYCLONE SEPARATION

Sanford Fleeter and Simon Ostrach Jun. 1966 116 p refs (Grant AF-AFOSR-194-66)

(FTAS/TR-66-12; AFOSR-66-1400; AD-637499) CFSTI: HC $4.00/MF $0.75

The paper considers the secondary-flow in a liquid-gas mixture in a cyclone separator. By means of a momentum integral method, an engineering approximation to the secondary (heavy fluid) flow rate is obtained which makes use of an experimental velocity profile determined by ter Linden. This flow rate approximation is physically realistic and is partially verified in the laboratory. Tests were run on a separator to determine the effect of the variation of certain operating conditions and geometric factors on the separation of a liquid-gas mixture. The effect of these variations on the efficiency of separation and pressure drop across the separator as functions of the Reynolds and Weber numbers is presented. (Author) TAB

N66-39768# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EFFECT OF NONEQUILIBRIUM DISSOCIATION ON THE FLOW AROUND DULLED BODIES WITH SUPERSONIC FLOW

Yu. P. Lun'kin and F. D. Popov 23 Feb. 1966 17 p refs Transl. into ENGLISH from Zh. Vychislitel'noi Mat. i Mat. Fiz. (Moscow), v. 4, no. 5, 1964 p 896-904

(FTD-TT-65-1666; TT-65-12649; AD-637384) CFSTI: HC $1.00/MF $0.50

Translation of Russian research: Effect of Nonequilibrium Dissociation On the Flow Around Dulled Bodies with Supersonic Flow. TAB

N66-39775# Midwest Research Inst., Kansas City, Mo.

MASS SPECTROMETRIC OBSERVATIONS OF ARGON CLUSTERS IN NOZZLE BEAMS. I; GENERAL BEHAVIOR AND EQUILIBRIUM DIMER CONCENTRATIONS

Thomas A. Milne and Frank T. Greene 15 Aug. 1966 33 p refs

(Contract Nonr-3599(00))

(AD-637177) CFSTI: HC $2.00/MF $0.50

Nucleation phenomena in nozzle beams were studied mass spectrometrically. The effect of pressure and orifice size on argon cluster distributions is presented together with a discussion of the factors affecting the interpretation of the cluster ion intensities. An extrapolation to zero orifice size for argon dimer mole fractions yields results in agreement with calculated equilibrium concentrations of Ar2 Author (TAB)

N66-39782# Avco Corp., Wilmington, Mass. Missile Systems Div.

A METHOD OF SOLVING THE THREE-DIMENSIONAL LAMINAR BOUNDARY-LAYER EQUATIONS WITH APPLICATION TO A LIFTING REENTRY BODY

Torstein K. Fannelop 9 Aug. 1966 165 p refs

(Contract AF 04(694)-890)

(AVMSD-0209-66-RM; BSD-TR-66-209; AD-637679)

The general three-dimensional laminar compressible boundary-layer equations, written in terms of streamline coordinates, are reduced to a sequence of two-dimensional equations by means of a systematic perturbation procedure. The perturbation parameter is related to the inviscid streamline curvature and the lowest (zeroth-order) equations are identical with the small crossflow equations of Hayes. In addition, the equations for the first-order terms are given explicitly both in terms of physical and transformed (Lees-Levy) variables. Two alternate finite difference methods (for physical and transformed variables respectively) are developed to solve the zeroth as well as the first-order equations exactly. Local similarity methods are also considered for comparison. A variety of boundary conditions are possible including the case for which the heat and mass-transfer rates are coupled through an energy balance. The methods were applied to the problem of boundary-layer flow on a blunted cone at angle-of-attack. The results show that the crossflow often becomes rather large near the wall. The first-order corrections to the enthalpy and tangential velocity in the boundary layer are nevertheless small Author (TAB)

N66-39807# Lockheed Missiles and Space Co., Palo Alto, Calif.

STABILITY OF THE LAMINAR BOUNDARY LAYER IN AN INCOMPRESSIBLE FLUID ON AN ELASTIC SURFACE

A. I. Korotkin [1966] 7 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. i Gaza (USSR), no. 3, 1966 p 39-44

CFSTI: HC $1.00/MF $0.50

The problem of interaction between an elastic surface and perturbations arising in a boundary layer is considered. A comparison of data for stability on a solid wall and computations by formulas, which are then extended to the case of an elastic surface, are presented. The problem of stability of a laminar boundary layer on a solid surface is reduced to solving the Orr-Sommerfeld equation by the method of small oscillations. Next the method used to compute stability for the solid surface is applied to the boundary conditions on a pliant surface. An analysis based on the obtained results is presented for the energy flux direction during interaction of pressure pulsations in the stream with the flexible wall. Formulas are presented for the stability of a laminar boundary layer on a surface pliant in the tangential direction. The presented formulas and the computational scheme are utilized to compute the neutral stability curve for any given velocity distribution in the boundary layer. S.P.

N66-39809# Lockheed Missiles and Space Co., Palo Alto, Calif.

FLOW OF A VISCOUS FLUID IN A TUBE WITH POROUS WALLS

G. A. Babadzhanian [1966] 6 p refs Transl. into ENGLISH from Izv. Akad. Nauk Arm. SSR, Ser. Fiz. Mat. Nauk. (Yerevan), v. 18, no. 4, 1965 p 73-79

CFSTI: HC $1.00/MF $0.50

Axisymmetric stationary motion of an incompressible viscous fluid in a circular tube with porous walls is considered. The permeability along the tube is assumed constant, and the gravity forces are neglected. It is also stated that the velocity of the motion is so small that the Navier-Stokes equations in cylindrical coordinates may be taken as the equations of motions. These equations, and the boundary conditions are reduced to nondimensional form and the solution to the problem is outlined. H.S.W.

N66-39818# Royal Aircraft Establishment, Farnborough (England).

ESTIMATE OF THE DRAG OF A LONG CIRCULAR CYLINDER ACCELERATING ALONG ITS AXIS FROM REST IN AN INFINITE FLUID

M. R. Abbott Feb. 1966 24 p refs

(RAE-TR-66062) CFSTI: HC $1.00/MF $0.50

An estimate is made of the time variation of the drag coefficient per unit length of a long circular cylinder during an acceleration from rest along its axis in an infinite fluid. Under the assumption of laminar flow, an equation is obtained which has a series solution useful for small values of time. An attempt is made to consider turbulent flow starting with a hypothesis for the shear. The resulting non-linear partial differential equation is solved by an iterative application of the Crank-Nicolson method, using step lengths in the radial direction that increase in geometrical progression. It is shown, for two examples relating to accelerations in water, that the computed drag coefficient for turbulent motion initially decreases rapidly, but thereafter varies only slowly with time. Author

N66-39825 # Deutsche Versuchsanstalt fur Luft-und Raumfahrt, Freiburg (West Germany). Institut fuer Angewandte Mathematik und Mechanik.

CONTRIBUTION TO THE CALCULATION OF TURBULENT BOUNDARY LAYERS IN TWO DIMENSIONAL INCOMPRESSIBLE FLOW [BEITRAG ZUR BERECHNUNG TURBULENTER GRENZSCHICHTEN IN ZWEIDIMENSIONALER INKOMPRESSIBLER STROEMUNG]

Karl-Otto Felsch Jul. 1965 124 p refs In GERMAN; ENGLISH summary

(DLR-FB-66-46; DVL-513) CFSTI: HC $4.00/MF $0.75

A new half-empirical law is deduced for the dissipation integral which—in contrast to the equations known up till now—also takes account of the history of the boundary layer. From a physical point of view this means that, in general, the shearing stress distribution is not uniquely connected with the mean velocity distribution. An essential prerequisite for the practical application of the new law is a one-parameter representation of a convenient shape parameter of the mean velocity distribution as a function of the condition of compatibility at the wall. It is shown by calculated examples that turbulent boundary layers and their separation, even in difficult cases, can be calculated much more accurately by the new dissipation law than used to be possible by the approximate theories known up to this day. Author

N66-39833# Royal Aircraft Establishment, Farnborough (England).

THE EQUATIONS OF MOTION OF A VISCOUS, COMPRESSIBLE GAS REFERRED TO AN ARBITRARILY MOVING CO-ORDINATE SYSTEM

F. Walkden (Royal Coll. of Advanced Technol., Salford) Apr. 1966 30 p refs

(RAE-TR-66140) CFSTI: HC $2.00/MF $0.50

The equations of motion of a viscous, compressible, heat conducting fluid are formulated. A tensor form for the equations of motion in a fixed cartesian system is derived and the methods of tensor analysis are used to obtain the appropriate representation of the equations of motion in a general co-ordinate system. Two examples are considered to show how the analysis presented may be used to obtain equations of motion appropriate to each case. Author

N66-39848# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE SUBDUED FOE

Yurii Temnikov 23 Feb. 1966 15 p Transl. into ENGLISH from Znaniye-sila (Moscow), no. 2, 1962 p 10–12

(FTD-TT-65-1692; TT-66-62086; AD-637385) CFSTI: HC $1.00/MF $0.50

A method for protecting turbine blades against cavitation is discussed. A chromium-magnesium austenite steel, which has seven to ten times greater anticavitation resistance than ordinary types, was used to coat turbine blades and it was found that this process was effective. The use of sodium diethyldithiocarbonate in diesel engines to reduce cavitation damage is also discussed. H.S.W.

N66-39862# New York Univ., N. Y. Dept. of Aeronautics and Astronautics.

ON THE NUMERICAL SOLUTION OF THE BOUNDARY LAYER EQUATIONS

Egon Krause Jun. 1966 52 p refs Presented at the SIAM Natl. Meeting, Iowa City, Iowa, 11–14 May, 1966

(Contract Nonr-285(63))

(NYU-AA-66-57; AD-637851) CFSTI: HC $3.00/MF $0.50

The numerical solution of the boundary layer equations by means of the implicit finite-difference scheme is examined in detail. Based on Ting's analysis of the compatibility condition for the velocity components at the initial station the present analysis shows that Flugge-Lotz and Blottner and Smith and Clutter overspecify the initial conditions. To be consistent with the formulation of the problem, a modification of the implicit finite-difference scheme is presented. While the original integration procedure for the momentum and energy equations is retained, the integration of the continuity equation is facilitated simultaneously by an iteration process. In this manner the difficulties at the start of the integration are eliminated and no additional initial conditions on the normal velocity component or the streamwise derivatives of u and T have to be imposed. Several numerical examples are included to demonstrate the application of the method.

Author (TAB)

N66-39942*# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.

BUBBLE FORMATION AND GROWTH: STUDY OF THE BOUNDARY CONDITIONS AT A LIQUID-VAPOR INTERFACE THROUGH IRREVERSIBLE THERMODYNAMICS Quarterly Progress Report, Mar.–May 1966

Walter J. Bornhorst and George N. Hatsopoulos Jun. 1966 28 p

(Contract NAS8-20013)

(NASA-CR-79014) CFSTI: HC $2.00/MF $0.20 CSCL 20D

The object of this theoretical investigation is to determine the importance of the nonequilibrium region, which exists at the bubble wall, on the growth of a vapor bubble. All previous investigators concerned with bubble growth have completely neglected this nonequilibrium effect. Results from a previous investigation of the phase change problem are applied here to solve the special problem of vapor bubble growth. The results are presented in terms of a two-parameter set of curves. These results show that for pressures where experimental results are available, the nonequilibrium effects are within experimental error; however, for pressures which are somewhat lower, the nonequilibrium effects become very important. Author

N66-39963# Brown Univ., Providence, R. I. Div. of Engineering.

THE RAYLEIGH PROBLEM IN A RADIATING COMPRESSIBLE GAS. PART 2: PLATE MACH NUMBER LARGE

Alexander Solan and Ira M. Cohen Jul. 1966 43 p refs

(Contract Nonr-562(35))

(Nonr-562(35)/11; AD-637935) CFSTI: HC $2.00/MF $0.50

The Rayleigh problem for a compressible radiating gray gas is analyzed by asymptotic methods and solved numerically for one limiting case. The problem is formulated for large ratio of the photon to molecular mean free path N, large Mach number M, and general values of the Boltzmann number B0. Using Kruskal's 'Principle of Maximal Complication,' a detailed formal asymptotic analysis is carried out for various combinations of N, M, and Bo. Attention is focused on those limiting cases in which the asymptotic scaling of main interest yields an optically thin hot boundary layer with emission but no absorption, which may be solved independently of the corresponding outer flow. One representative case of such boundary-layer flow is solved numerically. Author

N66-39981*# National Aeronautics and Space Administration, Washington, D. C.

ABSORPTION OF HIGHLY SOLUBLE GASSES BY HIGH SPEED AXIAL FLOW ATOMIZING EQUIPMENT [ISSLEDOVANIYE VYSOKOSKOROSTNYKH PRYAMOTOCHNYKH RASPYLITEL'NYKH APPARATOV PRI ABSORBTSII KHOROSHO RASTVORIMYKH GAZOV]

V. I. Matrozov, V. M. Ramm, and Z. V. Chagina Nov. 1965 25 p refs Transl. into ENGLISH from Khim. Mashinostr. (Mashgiz), no. 2, [1965] p 46–52

(NASA-TT-F-9724) CFSTI: HC $1.00/MF $0.50 CSCL 20D

Three different instruments were used under identical conditions. The instruments were: (1) Venturi absorbers without a jet orifice and with a throat diameter of 34 and 48.5 mm; (2) the identical Venturi absorbers with a jet orifice; and (3) an atomizing

absorber with a throat diameter of 20mm, similar to the Venturi absorber except that the liquid was supplied in form of a film and there was no diffuser. An ammonia–water system was used in the experiments, which made it possible to obtain data for the mass transfer which can be applied to other highly soluble gases. Measured were initial ammonia concentration and content before and after absorption; air and water consumptions; pressure drop in the instruments; and temperatures of the gas and liquid upon entering and leaving the instruments. Gas mass velocity during the experiments was 23–48 kg/m^2-sec), the specific liquid consumption was 1–6 l/m^3. Measured data were evaluated, and the validated data were used to determine the number of transported units in respect to gas concentration. It is suggested that the results be verified with equipment of larger size. K.W.

N66-39984*# Wyle Labs., Inc., Huntsville, Ala.
PROPAGATION OF WAVES OF FINITE AMPLITUDE IN THERMOVISCOUS MEDIA
Ervin Y. Rodin Washington, NASA, Nov. 1966 88 p refs (Contract NAS8-11312)
(NASA-CR-643) CFSTI: HC $2.50/MF $0.75 CSCL 20D

This report contains a collection of new results, both qualitative and quantitative, concerning the nature of propagation of waves of finite amplitude in thermoviscous media; with particular attention to piston-driven propagation. The vehicle for the analysis is Burgers' equation, for which an appropriate boundary value problem is solved. Several critical nonlinear quantities are defined and discussed; criteria for the appearance of shocks are given; a generalized analytic explanation of the nature of nonlinear diffusion is given. An explicit quantitative solution for piston-driven propagation, also given here, is shown to contain, as a special case, Fay's result. Author

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N66-38867*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ELECTRON DENSITIES AND SCALE HEIGHTS IN THE TOPSIDE IONOSPHERE: ALOUETTE I OBSERVATIONS OVER THE AMERICAN CONTINENTS. VOLUME II: MARCH AND MAY 1963
Kwok-Long Chan, Lawrence Colin, and John O. Thomas Washington, NASA, 1966 610 p refs
(NASA-SP-3032) CFSTI: HC $6.50/MF $3.00 CSCL 04A

Tabulations are presented on the data analyses of the Alouette I topside sounder ionograms, which were chosen primarily for their nearly complete latitudinal 1963 over the American continents. In this pole-to-pole study, data are given on the electron density and plasma scale height at various heights and times in the topside ionosphere. M.G.J.

N66-38991# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTRON AND ION TEMPERATURES IN THE IONOSPHERE
T. K. Breus and G. L. Gdalevich *In its* Cosmic Res., Vol. III, No. 6 (1966) p 108–133 refs (See N66-38986 24-30) CFSTI: HC $6.00/MF $1.25

Contemporary theoretical conceptions and experimental data pertaining to the temperatures of electrons T_e and ions T_i in the ionosphere are described. It is noted that there is no temperature equilibrium between ions and electrons in the F region of the ionosphere. Information on the diurnal, latitude and altitude curves of electron temperature is presented. Comparison of theoretical and experimental values of T_e and T_i indicates the necessity of a broader range of direct electron- and ion-temperature measurements and the accumulation of data on such thermal sources as electrostatic fields, hydromagnetic waves, and fluxes of high-energy particles. Author

N66-39178# Florida Univ., Gainesville. Engineering and Industrial Experiment Station.
COASTAL ENGINEERING MODEL STUDIES OF THREE FLORIDA COASTAL INLETS
Per M. Bruun, J. A. Battjes, T. Y. Chiu, and J. A. Purpura Jun. 1966 62 p refs *Its* Eng. Progr. v. 20, no. 6; Bull. no. 122

CONTENTS:
1. NATURAL INLET REGIMEN P. M. Bruun p 1–11 refs (See N66-39179 24-13)
2. MODEL LAWS FOR COASTAL ENGINEERING STUDIES J. A. Battjes p 12–13 (See N66-39180 24-13)
3. MODEL STUDY OF SEBASTIAN INLET T. Y. Chiu p 14–34 (See N66-39181 24-13)
4. MODEL STUDY OF HILLSBORO INLET J. A. Purpura p 35–51 (See N66-39182 24-13)
5. MODEL STUDY OF LAKE WORTH INLET P. Bruun p 52–68 (See N66-39183 24-13)

N66-39179# Florida Univ., Gainesville. Engineering and Industrial Experiment Station.
NATURAL INLET REGIMEN
Per M. Bruun *In its* Coastal Eng. Model Studies of Three Fla. Coastal Inlets Jun. 1966 p 1–11 refs (See N66-39178 24-13)

Certain aspects of inlet stability, including cross-sectional stability and by-passing ability, are discussed in detail. Explanations are given for inlet stability phenomena, with special references to inlets in Florida. H.S.W.

N66-39180# Florida Univ., Gainesville. Engineering and Industrial Experiment Station.
MODEL LAWS FOR COASTAL ENGINEERING STUDIES
J. A. Battles *In its* Coastal Eng. Model Studies of Three Fla. Coastal Inlets Jun. 1966 p 12–13 (See N66-39178 24-13)

An introduction is given to the rules of model-prototype similarity, with special reference to coastal engineering models. A few key concepts in the theory of similitude are outlined, and some applications of this theory in practice are examined. Definitions are given of concepts which play a key role in a discussion of model research. These concepts are scale model, similarity, scales, model laws, and distortion. H.S.W.

N66-39181# Florida Univ., Gainesville. Engineering and Industrial Experiment Station.
MODEL STUDY OF SEBASTIAN INLET
T. Y. Chiu *In its* Coastal Eng. Model Studies of Three Fla. Coastal Inlets Jun. 1966 p 14–34 (See N66-39178 24-13)

A study was conducted to investigate the possibilities of improving the Sebastian Inlet which, because of high current and wave action, is dangerous to navigation. A description of the study area includes brief discussions of the winds, tides and currents, waves, swells, and littoral drift. An extensive hydrographic survey was carried out in the field. From the data obtained, a hydraulic model of the inlet and a small area of the ocean and bay were constructed. The important conclusions and resulting recommendations from the study are listed. H.S.W.

N66-39182# Florida Univ., Gainesville. Engineering and Industrial Experiments Station.
MODEL STUDY OF HILLSBORO INLET
J. A. Purpura *In its* Coastal Eng. Model Studies of Three Fla. Coastal Inlets Jun. 1966 p 35–51 (See N66-39178 24-13)

Combined field, model, and offices studies were conducted to determine in which way the inlet could be stabilized, and kept relatively free of shoaling in order to improve navigation. An extensive hydrographic survey was carried out, and from the data obtained a hydraulic model of the inlet proper and a small area of the ocean and bay were constructed. Consideration was also given to the effect that deepening and widening of the channel would have on wave action penetrating the inlet, and to the effect of the inlet on beach erosion. M.G.J.

N66-39183# Florida Univ., Gainesville. Engineering and Industrial Experiment Station.

MODEL STUDY OF LAKE WORTH INLET

Per M. Bruun *In its* Coastal Eng. Model Studies of Three Fla. Coastal Inlets Jun. 1966 p 52–68 (See N66-39178 24-13)

Detailed data are given on the studies undertaken to analyze the problems connected with (1) an uneven current distribution across the inlet channel, together with high wave activity at the inlet entrance and inlet channel; (2) deposition of sand at the north jetty of the inlet which causes the shoaling of the lake and the erosion of the beaches to the south; and (3) stagnation conditions in the lake waters which depend on the amount of water exchange between the ocean and the lake. Hydrographic surveys of the bottom topography were conducted. Tide recorders were operated in the inlet channel and in the bay, and current velocities were measured in the ocean, the inlet channel, and in the bay using floats, dyes, and observation of current patterns from airplanes. The model is described, and figures are included to depict the general layout. Tests of proposed improvements are assessed, and recommendations based on the results are presented. M.G.J.

N66-39251# Research Inst. of National Defence, Stockholm (Sweden). Uppsala Ionospheric Obs.

ROCKET EXPERIMENTS FOR STUDIES ON D-REGION ION CONCENTRATION AND EMISSION FROM RELEASED CHEMICALS IN TWILIGHT AND AURORA

W. Stoffregen, A. Pedersen, H. Derblom, B. Oeberg, G. Maseide et al 1966 114 p refs
(Rept.-15)

CONTENTS:

1. MEASUREMENTS OF ION CONCENTRATIONS IN THE D-REGION OF THE IONOSPHERE A. Pedersen p 9–32 refs (See N66-39252 24-13)

2. DEVELOPMENT AND CONSTRUCTION OF GERDIEN CONDENSER ROCKET PROBES A. Pedersen and B. O berg p 33–45 refs (See N66-39253 24-31)

3. INFLATABLE MYLAR PARACHUTES FOR HIGH ALTITUDES A. Pederson p 46–59 ref (See N66-39254 24-02)

4. OBSERVATIONS OF AN ARTIFICIAL SODIUM CLOUD IN TWILIGHT IN SOUTHERN FRANCE W. Stoffregen and H. Derblom p 60–63 refs (See N66-39255 24-13)

5. LIGHT EMISSION FROM AN ARTIFICIAL SODIUM–LITHIUM CLOUD RELEASED IN TWILIGHT H. Derblom and W. Stoffregen p 64–70 refs (See N66-39256 24-13)

6. EMISSION FROM A SODIUM TRAIL RELEASED INTO AN AURORA. PART I: OBSERVATIONS 100 km SE OF THE LAUNCH SITE H. Derblom and W. Stoffregen p 71–82 refs (See N66-39257 24-13)

7. EMISSION FROM A SODIUM TRAIL RELEASED IN AURORA. PART II: OBSERVATIONS FROM THE LAUNCH SITE K. Maseide p 83–91 refs (See N66-39258 24-13)

8. EXPERIENCE FROM AN ARTIFICIAL SHOCK-WAVE EXPERIMENT IN AN AURORA W. Stoffregen and H. Derblom p 92–95 refs (See N66-39259 24-13)

9. A SODIUM–LITHIUM POINT CLOUD PAYLOAD H. Derblom, S. Lamnevik, and O. Hellmouth p 96–99 refs (See N66-39260 24-13)

10. SOME INSTRUMENTS FOR NIGHT STUDIES OF UPPER ATMOSPHERE LIGHT EMISSIONS W. Stoffregen and H. Derblom p 100–107 refs (See N66-39261 24-14)

N66-39252# Research Inst. of National Defence, Stockholm (Sweden). Uppsala Ionospheric Obs.

MEASUREMENTS OF ION CONCENTRATIONS IN THE D-REGION OF THE IONOSPHERE

A. Pedersen *In its* Rocket Expt. for Studies of D-Region Ion Concentration and Emission from Released Chem. in Twilight and Aurora 1966 p 9–32 refs (See N66-39251 24-13)

A Gerdien condenser rocket probe has been developed for collection of ions and electrons in the D-region of the ionosphere. Laboratory experiments in a small wind tunnel with ionized air for determining the electrode configuration of the probe are described. Data from the first launchings at White Sands Missile Range, USA, showed concentrations of positive ions of the order of 10^4 cm^{-3} and of negative ions of the order 10^3 cm^{-3} in the height range 50–70 km. This indicated that heavy negative ions, which cannot be collected by the Gerdien condenser, were most probably present in the same height range. Heavy negative ions may be formed in chemical reactions or in clustering processes. Two rocket measuements of ion densities were later performed at Andoya, Norway, with a modified probe. The first experiment was made during quiet daytime conditions and resulted in measurements of ion densities from approximately 30–90 km height. The second shot was fired during a weak auroral event, and resulted in ion density measurements from approximately 30–85 km height. Author

N66-39255# Research Inst. of National Defence, Stockholm (Sweden). Uppsala Ionospheric Obs.

OBSERVATIONS OF AN ARTIFICIAL SODIUM CLOUD IN TWILIGHT IN SOUTHERN FRANCE

W. Stoffregen and H. Derblom *In its* Rocket Expt. for Studies of D-Region Ion Concentration and Emission from Released Chem. in Twilight and Aurora 1966 p 60–63 refs (See N66-39251 24-13)

An artificial sodium cloud produced by a French Centaur rocket at Ile du Levant has been studied by means of the auroral spectrophotometer, SP3, and cameras. The ratio D_2/D_1 of the sodium lines was recorded and found to be in agreement with theoretical values, indicating a large self-absorption within the cloud. Photographs in black–white and in colour show the development and diffusion of the cloud during about half an hour. Strong winds at about 100 km height with velocities of more than 200 m/s were recorded. Author

N66-39256# Research Inst. of National Defence, Stockholm (Sweden). Uppsala Ionospheric Obs.

LIGHT EMISSION FROM AN ARTIFICIAL SODIUM–LITHIUM CLOUD RELEASED IN TWILIGHT

H. Derblom and W. Stoffregen *In its* Rocket Expt. for Studies of D-Region Ion Concentration and Emission from Released Chem. in Twilight and Aurora 1966 p 64–70 refs (See N66-39251 24-13)

An artificial cloud produced in twilight by a new type of payload containing sodium azide and lithium azide has been studied. Resonance emission from both sodium and lithium has been observed by means of colour photographs. The effect of winds on the cloud is described. The technical function of the payload has been analysed and necessary improvements of the payload are discussed. Author

N66-39257# Research Inst. of National Defence, Stockholm (Sweden). Uppsala Ionospheric Obs.

EMISSION FROM A SODIUM TRAIL RELEASED INTO AN AURORA. PART I: OBSERVATIONS 100 KM SE OF THE LAUNCH SITE

H. Derblom and W. Stoffregen *In its* Rocket Expt. for Studies of D-Region Ion Concentration and Emission from Released Chem. in Twilight and Aurora 1966 p 71–82 refs (See N66-39251 24-13)

An artificial trail containing 2 kg of sodium has been released from a rocketborne vapourizer in the height range 85–165 km during an aurora of brightness IBC II. Strong sodium emission was observed over the entire trail during the release period showing two pronounced intensity minima at about 90 and 132 km height. After that, the emission decreased in less than 1 minute to a brightness ≈ 1 kR, the threshold of visibility. Photometers continued to record an enhanced emission from the injected sodium up to 40 minutes. During this period simultaneous variations in sodium and auroral emission were observed. A strong SW wind shear with a speed of the order of 100 m sec^{-1} was observed at 95 km level. The expansion of the cloud seems to be determined by winds rather than by diffusion. Author

N66-39258# Research Inst. of National Defence, Stockholm (Sweden). Uppsala Ionospheric Obs.

EMISSION FROM A SODIUM TRAIL RELEASED IN AURORA. PART II: OBSERVATIONS FROM THE LAUNCH SITE

K. Maseide *In its* Rocket Expt. for Studies of D-Region Ion Concentration and Emission from Released Chem. in Twilight and Aurora 1966 p 83–91 refs (See N66-39251 24-13)

Intensity measurements of the sodium D-lines, $\lambda = 5890\text{-}96$ Å, and the auroral nitrogen band N_2+ IN, $\lambda = 4278$ Å, have been made with a calibrated photometer located near the launch site and directed along the rocket trajectory. During the injection period a strong increase of the sodium emission within the field of view was observed, and augmented sodium emission could be recorded until about 15 minutes after the release had ceased. The observations seem to state that several excitation mechanisms are working to give the augmented sodium emission. One of these seems to be thermal excitation working within the vaporizer, and perhaps also in the sodium trail a few seconds after release. To explain the recorded emission from the long-lasting sodium trail, it appears that several kinds of chemical excitations must be taken into account. Author

N66-39259# Research Inst. of National Defence, Stockholm (Sweden). Uppsala Ionospheric Obs.

EXPERIENCE FROM AN ARTIFICIAL SHOCK-WAVE EXPERIMENT IN AN AURORA

W. Stoffregen and H. Derblom *In its* Rocket Expt. for Studies of D-Region Ion Concentration and Emission from Released Chem. in Twilight and Aurora 1966 p 92–95 refs (See N66-39256 24-13)

An experiment has been carried out to study the effect of a 20 kg TNT explosion in an aurora. The shock-wave from the explosion was expected to modulate the spectral emission form the aurora, and in this way make it possible to record the speed of the shockwave. In this first experiment the main interest was to test the method and to get some information concerning the temperature in an aurora. It was also expected that the local pressure increase should cause the incoming electrons to lose their energy at a slightly greater height and produce a local deformation of the aurora. Only a very feeble flash was visually observed from the detonation and it has not become clear whether the absence of an artificial effect was due to some technical failure. Author

N66-39260# Research Inst. of National Defence, Stockholm (Sweden). Uppsala Ionospheric Obs.

A SODIUM–LITHIUM POINT CLOUD PAYLOAD

H. Derblom, S. Lamnevik, and O. Hellmouth *In its* Rocket Expt. for Studies of D-Region Ion Concentration and Emission from Released Chem. in Twilight and Aurora 1966 p 96–99 refs (See N66-39251 24-13)

This report describes the development of a payload with a total weight of 9 lbs for release of sodium and lithium. A self-acting decomposition of sodium and lithium azides is used as the principle of the generator. Observations from the first launching indicate that it is necessary to increase the payload efficiency. Author

N66-39322# Tellurometer (Pty.), Ltd., Plumstead (Union of South Africa).

THE USE OF TELLUROMETER OBSERVATIONS IN ESTABLISHING A COORDINATE SURVEY CONTROL SYSTEM IN THE PROVINCE OF NEW BRUNSWICK, CANADA

G. Konecny and W. F. Roberts *In its* Proc. of the 1962 Tellurometer Symp. [1962] 63 p refs (See N66-39306 24-14) CFSTI: HC $6.00/MF $1.75

The paper describes the scheme of operations in which a Provincial Survey Control System is established in New Brunswick. For the breakdown of primary geodetic control tellurometer traverses are preferred over secondary triangulation. Interconnecting traverses are run by geodimeter but could be measured by tellurometer. Costs and accuracy are analyzed in detail, particularly the discrepancies between measured distances and the geodetic net, which have led to the introduction of a geodetic factor to be used in adjustments. Traverse Closures are studied for various aspects. The Summary concludes that the use of electronic survey aids has not only made coordinate surveys more economical but also more accurate. Author

N66-39325# Hunting Surveys, Ltd., Boreham Wood (England).

HIGH ORDER TELLUROMETER TRAVERSING IN THE NIGER DELTA

G. K. Allisstone *In* Tellurometer (Pty.), Ltd. Proc. of the 1962 Tellurometer Symp. [1962] 14 p (See N66-39306 24-14) CFSTI: HC $6.00/MF $1.75

An extensive account is presented on the problems involved in defining the boundaries of oil and mining leases in the Niger Delta. The terrain is described, and the major difficulties encountered in gaining access to the area are discussed. As the use of triangulation of trilateration methods would be economically unfeasible, the problem was tackled by traversing along the banks of the creeks using electronic distance measuring instruments. One master and two remote tellurometers were used, plus conventional survey instruments. Details are given on the logistics, the working and living conditions of the crew, and the various approaches which were tried. Measurement results for various types of terrain are assessed, and it is pointed out that the project showed the practicality of using tellurometers for shots over an entirely water path. M.G.J.

N66-39326# Institut fuer Angewante Geodaesie, Frankfurt am Main (West Germany).

TELLUROMETER MEASUREMENTS IN BASE LINE EXTENSION FIGURES

K. Gerke *In* Tellurometer (Pty.), Ltd. Proc. of the 1962 Tellurometer Symp. [1962] 19 p (See N66-39306 24-14) CFSTI: HC $6.00/MF $1.75

Geodetic base lines within the primary triangulation network of Western Europe were measured by master and remote tellurometers under different meteorological conditions. The carrier frequency was used over the largest possible scale by steps of one unity; on some occasions, even smaller steps were used. Tabulated data are presented to compare these results with the trigonometrical measurements and the trigonometrical determinations. Based on the findings, it was concluded that the tellurometer has the capacity to execute geodetic measurements of the kind described. M.G.J.

N66-39327# Institut Belge pour la Recherche Scientifique, Outremer.
TELLUROMETER MEASUREMENTS ALONG THE LUALABA RIVER
E. G. Ghion *In* Tellurometer (Pty.), Ltd. Proc. of the 1962 Tellurometer Symp. [1962] 3 p (See N66-39306 24-14) CFSTI: HC $6.00/MF $1.75

One master and three remote tellurometers, theodolites, and levels were used in the topographical survey of the area, which was covered with dense tropical vegetation. The pattern of the primary chain resembled a double traverse of 66 stations tied at both ends to astronomical azimuths. The spacing of stations varied between 350 and 18,000 meters. The altitudes of the stones were fixed by trigonometric leveling and were connected to the general leveling of the country. A secondary chain of 96 stations was measured at the same time. A preliminary angular computation showed that the mean error of the measured angle was 1"5 (sex.). The weights assigned to the distances were deducted from these data and from the accuracy of the distance measurement, which was characterized by the mean error resulting from the square combination of an absolute error of 5 cm, and a relative error of 1/200,000 in the measured distance. M.G.J.

N66-39412# Joint Publications Research Service, Washington, D. C.
GENERAL CIRCULATION OF WATER MASSES
A. K. Leonov 21 Sep. 1966 19 p refs Transl. into ENGLISH from Regional'naya Okeanogr. (Leningrad), Pt. 1, 1960 p 109–118 (JPRS-37745; TT-66-34173) CFSTI: $1.00

The constant currents which influence the waters of the Bering Sea are discussed. The effects of seasonal variations are assessed as well as the effects of the mass of the Pacific Ocean current, and its intensity. The currents caused by the wind, gradient, pressure gradient, discharge, surges, and the ebb and flow of the tide are also briefly mentioned. H.S.W.

N66-39431# Joint Publications Research Service, Washington, D. C.
ATMOSPHERIC TURBULENCE RESEARCH 27 Sep. 1966 64 p refs Transl. into ENGLISH of the Russian publ. (JPRS-37855; TT-66-34283) CFSTI: $3.00

CONTENTS:

1. SPECTRA OF TURBULENT PULSATIONS OF THE VERTICAL COMPONENT OF WIND VELOCITY IN ATMOSPHERIC BORDER STRATA UNDER CONDITIONS OF WELL-DEVELOPED CONVECTION C. M. Koprov p 1–14 refs (See N66-39332 24-13)
2. THE STRUCTURE OF ATMOSPHERIC TURBULENCE A. S. Monin p 15–54 refs (See N66-39333 24-13)

N66-39432# Joint Publications Research Service, Washington, D. C.
SPECTRA OF TURBULENT PULSATIONS OF THE VERTICAL COMPONENT OF WIND VELOCITY IN ATMOSPHERIC BORDER STRATA UNDER CONDITIONS OF WELL-DEVELOPED CONVECTION
C. M. Koprov *In its* Atmospheric Turbulence Res. 27 Sep. 1966 p 1–14 refs Transl. into ENGLISH from Fiz. Atm. i Okeana (Moscow), v. 1, no. 11, 1965 p 1151–1159 (See N66-39431 24-13) CFSTI: $3.00

The spectra of pulsations of the vertical component of the wind velocity were measured using an acoustic anemometer installed on an aircraft. The spectrum of frequencies measured corresponds to the region of scales up to several kilometers. Relationships are established between height dissipation velocity of turbulent energy, dispersion of pulsations, and scale L, corresponding to the maximum of function $F_w(k)k$. Results obtained are compared with theoretical data. Author

N66-39433# Joint Publications Research Service, Washington, D. C.
THE STRUCTURE OF ATMOSPHERIC TURBULENCE
A. S. Monin *In its* Atmospheric Turbulence Res. 27 Sep. 1966 p 15–54 refs Transl. into ENGLISH from Teoriya Veroyatnostei i ee Primeneniya (Moscow), v. 3, issue 3, 1958 p 285–317 (See N66-39431 24-13) CFSTI: $3.00

Theoretical information and experimental data about statistical characteristics of turbulent pulsations of wind velocity and temperature in the lower layer of the atmosphere are presented. The information is useful for solving problems of geophysics and technology such as heat and moisture transfer and dynamic interaction of the underlying surface with the atmosphere, resultant transformation of air masses, microclimate of agricultural crops, spreading of impurities in air, scattering of sound and radio waves in atmospheric heterogeneities, flickering of stars, etc. Only steady state conditions of turbulence in the surface layer of air above a homogeneous underlying surface are considered. R.N.A.

N66-39435# Minnesota Univ., Minneapolis. School of Physics.
ATMOSPHERIC PHYSICS RESEARCH Annual Progress Report, Period Ending 31 May 1966
Jun. 1966 52 p refs
(Contract Nonr-710(22))
(AP-24; AD-636593) CFSTI: HC $3.00/MF $0.50

CONTENTS:

1. AN EXPERIMENTAL STUDY OF THE EQUATION OF MOTION IN THE FREE ATMOSPHERE H. T. Mantis p 1–36 refs (See N66-39336 24-13)
2. THE VERTICAL DISTRIBUTION OF DUST J. M. Rosen p 37–41 refs (See N66-39337 24-13)
3. SOLAR EXTINCTION F. C. Gillett and T. J. Pepin p 42–44
4. DUST COLLECTION FROM THE STRATOSPHERE J. M. Rosen p 45–50 refs (See N66-39338 24-13)
5. STELLAR EXTINCTION AND SCINTILLATION p 51

N66-39436# Minnesota Univ., Minneapolis. School of Physics.
AN EXPERIMENTAL STUDY OF THE EQUATION OF MOTION IN THE FREE ATMOSPHERE
Homer T. Mantis *In its* Atmospheric Phys. Res. Jun. 1966 p 1–36 refs (See N66-39435 24-13) CFSTI: HC $3.00/MF $0.50

Results of an experimental study to determine the representative magnitudes of various terms of the equation of motion as applied to motions of synoptic scale in the free atmosphere at the 500 mb and 300 mb levels, are reported. The magnitude of the following quantities were estimated: atmospheric accelerations at synoptic scale, frictional force at synoptic scale, synoptic scale departure of the wind from geostropic equilibrium, and the smaller scale structure of the wind observed by radiosonde. Statistics on the magnitude of the first and second horizontal derivatives of the field of isobaric height were computed. Speculation is made concerning the applicability of this data as a climatological guide in constructing or testing models of large scale atmospheric flow. The poleward transport of momentum was found to occur in a systematic pattern of accelerations. Implications as to the usefulness of this data for models of the general circulation are discussed. S.C.W.

N66-39437# Minnesota Univ., Minneapolis. School of Physics.
THE VERTICAL DISTRIBUTION OF DUST
James M. Rosen *In its* Atmospheric Phys. Res. Jun. 1966 p 37–41 refs (See N66-39435 24-13) CFSTI: HC $3.00/MF $0.50

Peculiarities of the vertical distribution of dust and ozone in the region of the lower stratosphere and upper troposhere are discussed. S.C.W.

N66-39438# Minnesota Univ., Minneapolis. School of Physics.
DUST COLLECTION FROM THE STRATOSPHERE
James M. Rosen *In its* Atmospheric Phys. Res. Jun. 1966 p 45–50 refs (See N66-39435 24-13) CFSTI: HC $3.00/MF $0.50

The initiation of an experiment focusing on the collection of a small amount of stratospheric dust for laboratory study is reported. Presented is a description of the proposed sampling instrument, and techniques which will be employed to estimate particle size distribution. Since the sampling volume is 3×10^5 cm^3, the largest particle expected is about 6μ diameter. It is noted that volume of 100 cubic meters would be necessary to obtain a few particles of 20μ diameter. A comparison of the results of this experiment with those of the photoelectric dust counter will show what portion of the particles are opaque, and will probably indicate how the aerosol concentration in the stratosphere is altered by water vapor. The origin of the dust can be determined by looking for cosmogenic nuclides induced by the solar wind. Chemical analysis will not be possible with the small sample obtained. S.C.W.

N66-39454# Naval Radiological Defense Lab., San Francisco, Calif.
RADIOACTIVITY RELEASE FROM RADIONUCLIDE POWER SOURCES. II: RELEASE OF STRONTIUM TITANATE TO THE OCEAN ENVIRONMENT
Harry A. Goya, Ming G. Lai, and Don A. Kubose 24 Apr. 1966 16 p refs
(Contract AT(49-5)-7084(2))
(USNRDL-TR-1042; AD-637517) CFSTI: HC $1.00/MF $0.50

In a program to determine the dissolution behavior in the ocean of radioactive fuels used as space vehicle power sources, rates of release of radionuclides from fuel-simulants to seawater had been measured in the laboratory. However, the experimental conditions did not account for factors existing in the natural environment. A companion study was made with two fuel-simulant speciments immersed in the ocean, with extensive limitations because of the lack of experimental control. For one of the specimens, the release rate approximated that obtained in the laboratory work. For the other, the rate was higher by an order of magnitude. The increase could be attributed only to the action of biological growth on the specimen, since no other significant parameters could be investigated. The large release of radioactivity in an ocean environment indicates the necessity for in-situ testing as well as laboratory testing Author (TAB)

N66-39501# American Meteorological Society, Boston, Mass.
HELICOPTER-BORNE RADIOMETEOROGRAPH [VERTOLETNYI RADIOMETEOROGRAF]
Iu. S. Dovgaliuk, V. I. Miukhkiura, and G. A. Tiul'kova Bedford, Mass., AFCRL, Jun. 1966 11 p Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 140, 1963 p 65–70
(Contract AF 19(628)-3880)
(T-R-611; TT-66-62120; AD-637466) CFSTI: HC $1.00/MF $0.50

The construction of a helicopter-borne radiometeorograph developed from the A-22 radiosonde at the main geophysical observatory is analyzed. The electronic circuitry and the results of field and laboratory testing of the instruments are described. Author (TAB)

N66-39564# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.
REMARKS CONCERNING I. F. MONIN'S SHORT COMMUNICATION ON CALCULATING DEFLECTIONS OF THE VERTICAL [ZAMECHANIYA PO POVODU KRATKOGO SOOBSHCHENIYA I. F. MONINA O VYCHISLENII CALCULATING OTVESA]
V. F. Yeremeyev and M. I. Yurkina Jul. 1966 8 p refs Transl. into ENGLISH from Tr. Tsentral. Nauchn.-Issledovatel. Inst. Geodezii, Aeros'yemki i Kartografii (Moscow), issue 157, 1965 p 135–138
(ACIC-TC-1093; TT-66-62129; AD-637537) CFSTI: HC $1.00/MF $0.50

It is demonstrated that the method proposed by I. F. Monin (Astronomicheskiy zhurnal (Astronomical Journal), 1963, XL, No. 1, pp. 179-183) is not applicable to practical use. It is further shown that the first and the second methods of Molodensky (Trudy TsNIIGAiK (Transactions of the Central Scientific-Research Institute of Geodesy, Aerial Surveying, and Cartography), 1949, issue 68, 5-11, and 1960, issue 131) of numerical solution of his integral equation for density of a single layer substituted for the attraction of anomalous masses in the interior of the Earth promptly lead to a higher accuracy than that of the Stokes theory applied to the real Earth. The results of calculations carried out (Trudy TsNIIGAiK, 1950, issue 75, 11-77, and 1954, issue 103, 65-117) by Yeremeyev and Yurkina in accordance with the first of these methods are also much more accurate as compared with the Stokes approximation, and are in fact near the correct values Author (TAB)

N66-39568# Boeing Scientific Research Lab., Seattle, Wash.
SEISMIC DAMPING AND CREEP IN THE MANTLE
E. Orowan Jun. 1966 74 p refs
(D1-82-0545; AD-637264) CFSTI: HC $3.00/MF $0.75

A unified theory of viscosity and viscoelasticity of the molecular-rearrangement type is given in which the two phenomena appear as special cases. The Becker theorem is reviewed; with the Becker distribution of relaxances, the distribution function of activation energies is a constant, viscoelastic creep is logarithmic and the specific damping 1/Q is frequency insensitive in wide ranges of time and frequency. The vibrating-string theories of dislocation damping in general are not feasible because the mean thermal kinetic energy of the basic mode is smaller by order of magnitude than the Peierls-Nabarro dissipation already for amplitudes equal to the Burgers vector for most materials. Low-amplitude damping is treated as a consequence of the perturbation of the activation energies of thermally activated jumps of dislocation segments by the applied stress; since the distribution function of the activation energies is probably close to the Becker distribution, the resulting damping is insensitive to frequency and amplitude and increases steeply with the temperature. The Amontons law of solid friction breaks down at very small amplitudes of displacement, such as those between the walls of small cracks in rocks. The simplest generalization of the Amontons law to include small amplitudes leads to an amplitude- and frequency-independent damping. TAB

N66-39588# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TURBULENCE ASSOCIATED WITH TEMPERATURE STRATIFICATION OF THE ATMOSPHERE
Pei-Mien Pak 26 Mar. 1966 29 p refs Transl. into ENGLISH from Ch'i Hsiang Hsueh Pao (Peking), v. 34, no. 2, 1964 p 211–224
(FTD-TT-65-608; TT-66-62092; AD-637414) CFSTI: HC $0.50

On the basis of detailed physical analysis with the aid of dimension theory, the paper makes an attempt to discuss, in general terms, certain aspects of turbulence with various types of stratification. The tendency to transit from a state of forced convection to free convection is assumed to be continuous. In the case of limit stability, the hypothesis is advanced that the turbulent state is independent of the dynamic factor. A dimensionless universal function that satisfies the requirements of physical analysis is derived. Numerical values of the parameters appearing in the function were determined from observational data. Methods are given for determining the turbulence coefficient and the flows of heat, moisture and momentum from gradient observation data; a

procedure is suggested for practical application of the method set forth. The formulas proposed were checked against observational material from various sources Author (TAB)

N66-39600# RAND Corp., Santa Monica, Calif.
DISTRIBUTION OF THE SOUTHERN AURORAL ZONE
E. H. Vestine Aug. 1966 21 p refs Presented at the Symp. on Pacific Antarctic Sci., The 11th Pacific Sci. Congr., Tokyo Univ., 23–27 Aug. 1966 Submitted for Publication
(P-3416; AD-637611) CFSTI: HC $1.00/MF $0.50

The historical development of the knowledge of the geographical distribution of aurora in the Antarctic is reviewed. The results for the IGY and later years as given by Davis, Gartlein, Feldstein, and others are summarized. Data on azimuth of auroral arcs at various hours of the day are presented. The equatorward expansion and broadening of the auroral belt with world-wide features of magnetic storms are noted. Specific instances of auroral belt positions during very great and very weak magnetic disturbances are noted. This belt appears interlinked with the corresponding belt in the Arctic. The spatial relationships to geomagnetic and other geophysical phenomena are summarized Author (TAB)

N66-39624# Joint Publications Research Service, Washington, D. C.
THE EARTH'S CRUST AND THE UPPER MANTLE OF THE CONTINENTS
V. V. Belousov 23 Sep. 1966 184 p refs Transl. into ENGLISH from "Zemnaya Kora i Verkhnyaya Mantiya Materikov" Moscow, Izd.-Vo "Nauka" 121 p
(JPRS-37800; TT-66-34228) CFSTI: $5.00

The principal characteristics of the structure and development of the continental tectonosphere (earth's crust and mantle) are discussed on the basis of comparative data from geology, geophysics, and geochemistry. General processes in the development of the tectonosphere are outlined, and a new model of crustal structure proposed in which the basalt layer is replaced by a layer of degranitization, represented by metamorphic rocks of the granulite facies. The periodicity of tectogenesis is hypothetically related to the gradual development of polymorphic increase of density in the C layer. Results of approximate energy computations show that the principles of the proposed mechanism of deep processes (cooling, heating, thermal energy release, etc.) are valid. R.LI.

N66-39646# Mandrel Industries, Inc., Houston, Tex.
STUDY OF SEISMIC SIGNALS AND NOISE BY MEANS OF A BURIED ARRAY Final Scientific Report, 1 Feb. 1964–1 Feb. 1966
G. C. Phillips and Changsheng Wu Jun. 1966 118 p refs
(Contract AF 19(628)-3888; ARPA Order 292; Proj. Vela Uniform) (MI-P-3614; AFCRL-66-578; AD-637687) CFSTI: HC $4.00/MF $0.75

Spectral treatments on short period (0.5–5.0 cps) seismic noise obtained from four different sites with a small buried seismometer array at shallow depths were performed. The results obtained at the Houston site indicate (1) that the coherence of different components of the same array is high; (2) that wavelet packets may be followed from one seismometer to another; (3) that particle velocity decreases approximately exponentially both with depth of burial and frequency; and (4) that the velocity of propagation of noise at depths less than 150 ft is about 1150–1250 ft/sec in nearly horizontal directions of propagation. These results suggest that in this area much of the seismic noise near 2 cps is probably due to air-coupled Rayleigh waves generated by infrasonic waves of about 2 dynes/cm^2 in the atmosphere. The S-wave velocity in the weathering layer is less than the sound wave velocity in air, thus providing the necessary condition for air coupling. This constant frequency is determined by the phase velocity curve; a minimum in the group velocity curve near this frequency may contribute to the predominance of these waves. Similar results were also obtained at Montana sites and Tennessee site except the seismic noise propagates at higher velocities. Author

N66-39659# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A STUDY OF THE CAPABILITY OF A LASA TO AID THE INDENTIFICATION OF A SEISMIC SOURCE
Howard W. Briscoe and Robert M. Sheppard 11 Jul. 1966 37 p refs *Its* Tech. Note 1966-38
(Contract AF 19(628)-5167; ARPA Order 512; Proj. Vela Uniform) (ESD-TR-66-362; AD-637283) CFSTI: HC $2.00/MF $0.50

Several studies have been performed to investigate the ability of a LASA or a network of LASAs to aid in discriminating between explosions and natural earthquakes from observations of the seismic waves they generate. The major effort has been an attempt to relate the ability to observe the pP phase, first motion, and complexity of an event to the well-documented ability of LASA to improve signal-to-noise ratio. The results indicate that the ability to see first motion varies directly with SNR, but that the ability to identify pP is apparently improved more than the SNR gain would indicate, probably due to the ability of a large array to measure velocity directly. In this study, no quantitative gauge for defining the correct value of complexity has been found; therefore, we made no attempt to estimate a level of improvement for determination of complexity. It appears that complexity can vary widely between different subarrays and, of course, combining subarrays tends to smooth out the variations. Two experiments designed to take advantage of the high SNR gains available at the lower frequency end of the short-period band (0.1 - 1.0 cps) are in progress. One of these, an attempt to observe S-wave energy on small events, has been hampered by an unexpected and, as yet unexplained high level of signal distortion. The other study, designed to investigate the pattern of P-wave spectra in the 0.1 to 1.0 cps region, has indicated that the energy in this band may be lower for explosions than for earthquakes, but it is too early in the study to state quantitative results Author (TAB)

N66-39676# Technical Operations Research, Burlington, Mass.
ANALYSIS OF PHOTOGRAPHS OF CHEMILUMINESCENT TRAILS IN THE UPPER ATMOSPHERE Final Report, Jul. 1964–Jun. 1966
Ronald H. Johnson 31 Jul. 1966 25 p refs
(Contract AF 19(628)-4300)
(TO-B-66-62; AFCRL-66-526; AD-637684) CFSTI: HC $1.00/MF $0.50

Photographs of chemiluminescent trails that were released in the upper atmosphere by AFCRL were quantatively reduced. The data obtained from two-dimensional isodensity plots were used to calculate the resultant diffusion coefficients at several altitudes from three of these trails. A photographic masking technique was used to remove density variations on the films caused by the sky background Author (TAB)

N66-39690*# Pennsylvania State Univ., University Park. Dept. of Electrical Engineering.
CHARGED PARTICLE TEMPERATURES AND ELECTRON THERMAL CONDUCTIVITY IN THE UPPER ATMOSPHERE Scientific Report No. 276
Peter M. Banks 15 Jul. 1966 38 p refs
(Grant NsG-134-61)
(NASA-CR-78936) CFSTI: HC $2.00/MF $0.50 CSCL 03B

An analysis is made of the effect of electron-neutral particle collisions and an appropriate expression is developed for the electron thermal conductivity which is applicable to a weakly ionized plasma. It is found that a correction term needed to include the effect of neutral particles is of importance during both day and night at all altitudes below 220 km. In fact, at altitudes below 135 km it appears that the conduction term can be neglected in the

electron energy balance equation. Using the derived expression for the effective electron thermal conductivity, an example of calculated temperatures characteristic of quiet solar conditions is presented. Author

N66-39693*# IIT Research Inst., Chicago, Ill.
A HIGH ALTITUDE MEASUREMENT TO DETERMINE THE RATIO OF DEUTERIUM TO HYDROGEN IN THE SOLAR ATMOSPHERE Final Report, 1 Jun. 1965–30 Mar. 1966
Gordon Henderson [1966] 32 p refs
(Contract NASr-65)
(NASA-CR-78931; IITRI-A6141-FRI) CFSTI: HC $2.00/MF $0.50 CSCL 04A

Two optical systems have been investigated, each of which showed potential capability of providing a system capable of measuring the D/H ratio in the sun's atmosphere by observing the H_{α} Fraunhofer line. These were: (i) An optical system consisting of a pair of Fabry–Perot interferometers in series which are scanned coherently. The interferometers are preceded by a narrow band interference filter. (ii) An optical system consisting of a single Fabry–Perot interferometer in series with a scanning monochromator of the grating type. The interferometer and monochromator are scanned coherently. Author

N66-39694*# Illinois Univ., Urbana. Electrical Engineering Research Lab.
IONOSPHERIC ELECTRON DENSITY DURING SOLAR ECLIPSE OF 20 JULY 1963
J. R. Cornellier and T. R. Pound [1966] 56 p refs
(Grants NsG-24; NSF GP-411)
(NASA-CR-78930) CFSTI: HC $3.00/MF $0.50 CSCL 04A

Data derived from ionograms obtained during the solar eclipse of July 1963 are discussed according to height intervals, since the range of the electron density profiles spanned the height intervals associated by convention with the E, F1, and F2 regions of the ionosphere. The similarities and dissimilarities in the observations at different ionosonde stations are noted, and probable causes of the observed behavior with reference to processes occurring in the ionosphere are investigated. The electron density continuity equation is reviewed and interpretation of the parameter S_{cat}, which is related to the thickness of the F2 peak, is discussed. S. P.

N66-39695*# Pennsylvania State Univ., University Park. Dept. of Electrical Engineering.
A METHOD FOR THE DETERMINATION OF MEAN IONOSPHERIC HEIGHT FROM SATELLITE SIGNALS Scientific Report No. 278
Daryal Kuntman 30 Aug. 1966 57 p refs
(Grant NsG-114-61)
(NASA-CR-78913) CFSTI: HC $3.00/MF $0.50 CSCL 04A

A method is developed for the determination of mean ionospheric height by analysing radio signals from a beacon satellite. Two major effects of the ionosphere on the received signals, Faraday rotation and doppler dispersion, are measured. By searching for their consistency and using height dependence of the earth's magnetic field, it becomes possible to calculate mean ionospheric height along the focus of satellite directions from the observing station. The method is applied to a number of satellite passes involving both normal and unusual ionospheric conditions and height profiles are developed over a range of about five degrees of latitude. Author

N66-39709*# Pennsylvania State Univ., University Park. Dept. of Electrical Engineering.
RECOMBINATION COEFFICIENT OF THE NIGHTTIME F-REGION FROM INCOHERENT SCATTER MEASUREMENTS Scientific Report No. 279
Donald Regis Mc Crory 9 Sep. 1966 61 p refs
(Grant NsG-134-61)
(NASA-CR-78980) CFSTI: HC $3.00/MF $0.75 CSCL 04A

Profiles obtained at the Arecibo Ionospheric Observatory for one summer and one winter night have been used to study the nighttime recombination in the F-region. A considerable improvement in the consistency of the results is obtained by the use of the incoherent scatter measurements. It is shown that the summer results compare closely with those obtained previously. It was found that in winter the electron content did not decrease and hence a different method was used to calculate the recombination coefficient than was used for the summer data. On this basis, it was quite difficult to make any conclusions about the seasonal dependence of the recombination coefficient. Author

N66-39726# Texas Univ., Austin. Electrical Engineering Research Lab.
AN INVESTIGATION OF THE VARIABLE FREQUENCY DIPOLE–DIPOLE METHOD FOR DETERMINING SUBSURFACE RESISTIVITIES
F. W. Patrick and F. X. Bostick Jr. 15 Jul. 1966 86 p refs
(Contract Nonr-375(17))
(Rept.-144; AD-637503) CFSTI: HC $3.00/MF $0.75

In this report, the theoretical and some of the experimental features of the variable frequency dipole-dipole method of determining the electrical resistivities of the earths subsurface structures are investigated. This is essentially equivalent to determining the fields due to a dipole operated at frequencies ranging from DC to several hundred cycles in the presence of resistive inhomogeneities. Mathematical models consisting of homogeneous, isotropic layers are developed for the case when the source is an horizontal electric dipole and a vertical magnetic dipole. Normalized apparent resistivity curves are developed and compared with the equivalent curves one would obtain using the DC dipole method and the magnetotelluric method. It is shown that under certain conditions the variable frequency dipole-dipole method may be superior to them. Experimental data taken in the Delaware Basin, near Pecos, Texas is analyzed by comparison to layered models. The resulting models are compared to models obtained from well-logs and magnetotelluric data Author (TAB)

N66-39732# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SEISMIC DISCRIMINATION Semiannual Technical Summary, 1 Jan.–30 Jun. 1966
Paul E. Green, Jr. 30 Jun. 1966 37 p refs
(Contract AF 19(628)-5167)
(ESD-TR-66-250; AD-637308) CFSTI: HC $2.00/MF $0.50

The capabilities of the experimental Large Aperture Seismic Array (LASA) to detect, reprocess, and identify teleseismic signals were evaluated. The detailed results are summarized, and current performance of the physical elements of the system is discussed. Exploratory work on the following topics is described: a different method of measuring P-complexity, a novel scheme for wide-band seismometer calibration, processing of signals from a set of three-component seismometers, and a computer simulation of the LASA seismometer channel Author (TAB)

N66-39750# Boeing Scientific Research Labs., Seattle, Wash.
FAULT DISPLACEMENT AND SEISMIC MECHANISM IN SHALLOW-FOCUS EARTHQUAKES
E. Orowan Jun. 1966 32 p refs
(D1-82-0546; AD-637142) CFSTI: HC $2.00/MF $0.50

If, as found by Press and Jackson in the 1964 Alaska earthquake, the fault reaches down to depths of 100 or 200 km, the observed fault displacement at the surface corresponds to a stress drop of the order of 10 bar at the fault, far less than is compatible even with the low compressive strengths measured by Raleigh and Paterson on decomposing serpentine. Since the discrepancy cannot be explained by the frictional restraint of the

Coulomb layer, it is suggested that the small stress drop has two other causes: First, the fault layer hardens with increasing displacement by the branching of cracks and rotation of the blocks between them; second, there is an aseismic layer between the Coulomb layer and the Raleigh-Paterson region which is too soft to permit frictional fracture and does not contain materials of low fracture strength such as decomposing serpentine. Calculations on this basis give consistent values both of the fault displacement and the energy release. The mean annual displacement of seismic faults reflects displacements between the adjacent continental and oceanic blocks; the mean velocity of displacement is of the order of centimeters per year. If this were the consequence of a contraction or expansion of the earth rather than of convection, the earths radius would change by 1000 km or more in 200 million years, unless seismic activity of the present intensity existed only during a very small fraction of the life of the earth. Author (TAB)

N66-39761# Oregon State Univ., Corvallis.
INVESTIGATIONS ON THE SEISMICITY AND CRUSTAL AND SUBCRUSTAL STRUCTURES IN OREGON Final Report, 15 Mar. 1963–30 Jun. 1966
Peter Dehlinger [1966] 26 p refs
(Contract AF 19(628)-2778; ARPA Order 292; Proj. Vela Uniform) (ARPA-66-9; AFCRL-66-478; AD-637601) CFSTI: HC $2.00/MF $0.50

The investigation involved studying seismograms from local earthquakes recorded at stations in the Pacific Northwest states, developing local travel-time curves for Oregon and adjacent regions, studying the dispersion of surface waves traveling across the Northwest states and determining crustal structures from the dispersion, making seismic refraction studies along the coast line of Oregon to determine crustal thicknesses and depths to the Mohorovicic discontinuity, studying selected local earthquakes, determining faulting associated with selected earthquakes, and making analyses of focal depths of local shocks. Preliminary studies were also made on the seismicity of Oregon. A special seismic station was established at Klamath Falls to aid in this study. As a result of this project, local travel-time curves have been established for Oregon and adjacent regions, regional crustal and subcrustal structures have been described for the major features in Oregon, and studies are well under way on the nature of faulting associated with earthquakes in the Pacific Northwest states and on new methods for determining focal depths in the Northwest. Author (TAB)

N66-39765# Aeronautical Chart and Information Center, St. Louis, Mo.
CONCERNING COMPUTATION OF THE TERRAIN CORRECTION FOR GRAVIMETER OBSERVATIONS [K VOPROSO O VYCHISLENII POPRRAVKI ZA VLIYANIYE REL'YE FA PRI NABLYUDENIYAKH S GRAVIMETROM]
P. P. Makagonov and G. A. Solov'yev Jul. 1966 10 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Geol. i Razvedka (Moscow), no. 5, May 1965 p 122–127
(ACIC-TC-1091; TT-66-62128; AD-637536) CFSTI: HC $1.00/MF $0.50

The gravimetric investigations in the western Trans-Baykal region to prospect the Mesozoic granites that are associated with rare-metal ores, were based on the relative gravity-anomaly values connected with the surveys objectives. TAB

N66-39789# Texas Univ., Austin. Defense Research Lab.
GENERATION OF SEICHES IN LAKE TRAVIS, TEXAS BY ATMOSPHERIC DISTURBANCES
Glen E. Ellis and Jack A. Shooter 1 Jun. 1966 56 p refs (Contract Nonr-3579(01))
(DRL-A-257; AD-637598) CFSTI: HC $3.00/MF $0.50

The report describes a study, made at Lake Travis, Texas, of seiches generated by atmospheric disturbances. Two simple geometrical models are used to calculate the periods of the first few modes of both the longitudinal and transverse seiches. These calculations are compared to wave observations analyzed with statistical techniques. A coupling between long-period pressure waves in the atmosphere (infrasonic wave) and the water surface is indicated from the experimental observations. Author (TAB)

N66-39808# Lockheed Missiles and Space Co., Palo Alto, Calif.
ENERGY SPECTRUM OF SEA WAVES
A. I. Voznesenkskii and Iu. A. Netsvetaev [1966] 8 p refs Transl. into ENGLISH from Sudostroyeniye (Leningrad), no. 7, Jul. 1966 p 11–15
CFSTI: HC $1.00/MF $0.50

Sea waves are considered as a random process whose fundamental properties are characterized, as a function of time, by an energy spectrum (the spectral density of the wave ordinates). The energy spectrum is defined on the basis of representation of the actual sea waves as the sum of sinusoidal oscillations of different frequency with random phases. The process of the change in wave ordinates at a given point of the sea surface is expressed mathematically. Equations are also presented for the angular distribution of the wave energy. As a measure of the changeability of the ordinates of the spectrum, the nondimensional ratio of the variance of the ordinates to the square of its mathematical expectation is considered. It was concluded that the expounded method for approximating the waviness energy spectrum is suitable to describe the nonregular sea waves of different intensity. Variation of the spectrum parameters permits assignment of the most rigorous computational conditions for a structure subjected to the effect of waves. An analysis of the confidence limits for the spectrum ordinates will permit a judgment on the confidence of spectra calculated by records of waves of different duration. S.P.

N66-39826# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Steuer- und Regeltechnik.
DETERMINATION OF VERTICAL DISTRIBUTION OF THE DUST EXTINCTION COEFFICIENT BY LIGHT-SCATTERING MEASUREMENTS UP TO 2440 m ALTITUDE [BESTIMMUNG DER VERTIKALEN VERTEILUNG DES DUNST-STREUKOEFFIYIENTEN AUS STREULICHT-MESSUNGEN BIS IN 2440 m HOEHE]
Guenter Kuers (Ph.D. Thesis–Ludwig-Maximilians Univ.) Aug. 1966 50 p refs In GERMAN; ENGLISH summary
(DLR-FB-66-54; DVL-549) CFSTI: HC $2.00/MF $0.50

Measurements of spectral radiance of the sky are reported which have been carried out up to an altitude of 2440 meters, using a helicopter and a self-made radiation measuring device which is self-aligning its direction of view relative to the sun's direction. Results have been used to compute the vertical distribution of the dust extinction coefficient. Data from the south-western region of Munich yielded a reinforced decrease of the dust extinction coefficient in the altitude region around 1500 meters; this is explained by a temperature inversion at this level which has been proved by radiosonde ascents. The influences of water vapor absorption in the region of the absorption band flanks and of aerosol absorption on the measurement results are discussed. Author

N66-39854# Air Force Cambridge Research Labs., Bedford, Mass.
A DYNAMICAL MODEL FOR INVESTIGATION OF THE BIENNIAL EQUATORIAL STRATOSPHERIC OSCILLATION
Louis Berkofsky and Ralph Shapiro May 1966 31 p refs *In* Environ. Res. Paper No. 194
(AFCRL-66-329; AD-637716) CFSTI: HC $2.00/MF $0.50

An eight-level primitive equation model is constructed for study of the biennial oscillation. The longitudinal dependence is removed by integration around latitude circles, but the Reynolds stress terms are retained by parameterization in terms of the averaged flow. The forecast levels in the vertical are arranged so as to give the highest resolution at the highest atmospheric levels. The top layer extends from 0 to 2 mb, whereas the bottom layer extends from 500 to 1000 mb. The energy source is related to variable heating in the ozone layer by means of the normal season variations of insolation. It is assumed that the vertical distribution of heating is known. The calculations are to be carried out in 10-minute time steps, using 2 degrees of latitude grid spacing, extending from 30 degrees N to 30 degrees S latitude. The time scale is compressed so that a complete 1-year cycle in the energy source takes place in 4 months Author (TAB)

N66-39856# Kiruna Geophysical Observatory (Sweden).
AURORAL ZONE IONOSPHERIC RESEARCH Annual Summary Report, 1 Mar. 1965–28 Feb. 1966
Ludwik Liszka and Svante Westerlund 23 Mar. 1966 50 p refs
(Contract AF 61(052)-678)
(AFCRL-66-434; AD-637663) CFSTI: HC $2.00/MF $0.50

The orientation of the line of maximum within the diffraction patterns produced by satellite signals is studied. The observed spread of orientation is explained by variations of orientation and elongation of irregularities; in cases of unusually large spread by assuming a quasiisometric diffraction pattern. The analysis of three months observations of Faraday rotation observed on S-66 transmissions made at Kiruna Geophysical Observatory (phi = 67.8 degrees N, lambda = 20.3 degrees E) is presented. The ionospheric electron content along the subionospheric path of the satellite was computed for almost 400 transits. Also effective slab thicknesses were calculated using critical frequency values from 6 Scandinavian stations, covering an interval of 10 degrees of latitude. Latitudinal and diurnal variations of the ionospheric electron content and the effective thickness were studied. The most striking feature of the latitudinal variation of the total electron content was a distinct minimum at the southern boundary of the auroral zone during winter night-time. This minimum coincides with the trough observed by topside sounding satellites. Equipment used for recording and analysis of noise signals in the ELF and lower VLF band is described. The results of some preliminary measurements are given. An experiment is described by which false ELF signals are obtained and it is believed that some spectra shown in literature are obtained in a similar way Author (TAB)

N66-39878# Lockheed Missiles and Space Co., Palo Alto, Calif.
INVESTIGATION OF THE ANGULAR AND SPECTRAL DISTRIBUTIONS OF TERRESTRIAL RADIATION IN THE INFRARED RANGE OF THE SPECTRUM BY UTILIZING "COSMOS-45"
P. A. Bazhulin, A. V. Kartashev, and M. N. Markov [1966] 21 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 4, no. 4, 1966 p 601–618
CFSTI: HC $1.00/MF $0.50

Methods and results of investigations of terrestrial radiation obtained during flight of "Cosmos-45" are described. Data are presented on the angular, spectral, and geographic distributions of the thermal radiation fluxes and the earth's albedo. Information is reported on the measured infrared radiation fluxes of the ionosphere in the 0.8 to 4.5 and 4.5 to 8.5 um ranges on both the day and night sides of the earth. The existence of water vapor at altitudes of about 100 km in the regions of large water surfaces on earth is established. Author

N66-39940*# Volt Technical Corp., Washington, D. C.
METHOD ON ANISOTROPY DETERMINATION OF LARGE-SCALE IONOSPHERE IRREGULARITIES BY THE RADIOASTRONOMICAL METHOD
Yu. A. Korvura and Yu. L. Konrunkin 28 Sep. 1966 6 p ref Transl. into ENGLISH from Radiotekhn. i Elektron. (Moscow), v. 9, Sep. 1966 p 1543–1546
(Contract NAS5-12487)
(NASA-CR-79102; ST-RA-AI-10519) CSCL 04A

A method is described for the determination of anisotropy of large-scale ionosphere irregularities according to the results of measurements of irregular radioastronomical refraction in three directions. General effective formulas are obtained for the computation of parameters of the anisotropy ellipse and of its orientation. Author

N66-39952# Massachusetts Inst. of Tech., Cambridge.
INTERACTION OF ATMOSPHERE AND OCEAN DURING CLIMATIC FLUCTUATIONS Final Report
H. C. Willett and N. E. Clark May 1966 75 p refs
(Grant NSF G-24832)

An investigation was conducted to determine the degree and form of any significant feedback of atmospheric-oceanic interactions in shaping subsequent patterns of atmospheric circulation and climate. The preliminary analysis and interpretation of synoptic observations of atmospheric and sea surface elements are discussed including both the direct observational elements and the heat budget quantities calculated from the direct observational elements. Two amplifications of the initially selected observational data are presented. These deal with the temperature change from the first ten days to one month to the first ten days of the next, and with the use of daily pressure gradients to compute average monthly wind effects rather than monthly mean pressure gradients. The advisable supplementary phases of the study which will be undertaken if the investigation can be carried to its logical conclusion are outlined. These supplementary studies are suggested either by the preliminary results of the investigation or by the present accessibility of data that were not available when the investigation began. R.N.A.

N66-39953# Texas Univ., Austin. Antennas and Propagation Div.
REPORT OF RESEARCH ON EXPLORATION OF THE ATMOSPHERE BY RETURNS FROM A HIGH-POWERED VERTICAL SOUNDING RADAR
Alfred H. La Grone 31 Aug. 1966 23 p refs
(Grant NSF GP-2596)
(P-11)

A study of the characteristics of atmospheric anomalies giving rise to clear air radar echoes is made and reported. The study included the frequency and polarization characteristics of the clear air echoes. The polarization study included both the monostatic and bistatic cases. A meteorological model of the atmosphere was examined theoretically and compared with experimental data. The study indicated strongly that the clear air echo referred to as the dot angle originated with suspended particulate matter. Theoretical investigation of the clear air thermal indicated that it was not a likely source of the dot angle type echo. Author

N66-39998*# Geophysics Corp. of America, Bedford, Mass.
INVESTIGATION OF THE D AND E REGION DURING THE IQSY Final Report, 1964–1965
L. G. Smith, P. J. Mc Kinnon, and L. H. Weeks May 1966 120 p refs
(Contract NASw-1141)
(NASA-CR-79096; GCA-TR-66-16-N) CFSTI: HC $4.00/MF $0.75 CSCL 04A

This report describes an investigation of the ionosphere up to about 180 km during the second year of the International Quiet Sun Year (1964 to 1965). One series of rockets was launched on the NASA Mobile Launch Expedition in the South Pacific in a study of the latitude variation of the ionosphere. The other series of flights was made from Wallops Island in the study

of seasonal variation. The last flight of this series was used to investigate the phenomenon of anomalous winter absorption.
Author

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N66-38842# Joint Publications Research Service, Washington, D. C.
AN APPROXIMATE METHOD FOR DESIGN CALCULATION OF A MAGNETIC RECORDING SYSTEM FOR PULSE SIGNALS
A. I. Viches *In its* 22d All-Union Sci. Session devoted to Radio Day. Sect. on Radio Broadcasting, Electroacoustics and Sound Recording 9 Sep. 1966 p 20-24 refs (See N66-38838 24-07) CFSTI: $2.00

Approximate methods of analyzing the transient processes in linear multicascade circuits are reviewed, and it is pointed out that with an increase in the number of cascades the total false characteristics of this network with monotonic and limited characteristics of the individual cascades assumes a bell shape. The possibility of approximate calculations for evaluating the basic parameters of a magnetic recording system is discussed, based on the premise that the bell shape of the total pulse characteristic of the reproduction channel permits an exceptionally simple relationship of the basic characteristics of the system to a single parameter—the total equivalent dispersion of the bell function. A series of equations is formulated, and it is concluded that the relationship of the bell system characteristics to its dispersion permits selection of the necessary structural parameters with respect to the given output characteristics.
M. G. J.

N66-38843# Joint Publications Research Service, Washington, D. C.
CONDUCTOR HEADS FOR FERROGRAPHY
V. I. Yeremichev *In its* 22d All-Union Sci. Session devoted to Radio Day. Sect. on Radio Broadcasting, Electroacoustics and Sound Recording 9 Sep. 1966 p 25-27 refs (See N66-38838 24-07) CFSTI: $2.00

Summary data are presented on investigations conducted to improve ferrographic blocks of magnetic recording heads. The problems inherent in decreasing the sizes of the symbols are discussed in relation to increasing recording reliability and recording rate. Two heads which were studied are briefly described.
M.G.J.

N66-38844# Joint Publications Research Service, Washington, D. C.
THE PROBLEM OF MAGNETIC RECORDING ON A CARRIER WITH MAGNETIC PENETRABILITY GREATER THAN ONE
I. V. Yelagin *In its* 22d All-Union Sci. Session devoted to Radio Day. Sect. on Radio Broadcasting, Electroacoustics and Sound Recording 9 Sep. 1966 p 28-30 (See N66-38838 24-07) CFSTI: $2.00

The assumption is made that a magnetic carrier, with a magnetic penetrability noticeably greater than one, causes significant redistribution of the scattering field in the operating gap zone in the recording head, along with a significant increase in the effective gap. To test this assumption, the magnetic impressions formed on the carrier were counted by an ordinary differentiating head; the signal obtained was amplified, integrated, and reproduced in the corresponding time scale in oscillographic form. Experimental details are given, and results show that for contactless magnetic recording it is necessary to consider the shunting effect. Some positive results were obtained by using the corresponding geometry of the pole terminals of the recording heads. The determinate gain may be obtained by selecting a magnetic carrier with lowered penetrability or, where possible, decreased thickness.
M.G.J.

N66-38845# Joint Publications Research Service, Washington, D. C.
SOME SPECIAL FEATURES OF OPERATION OF SPECTRA TRANSFORMERS
V. M. Chernitser *In its* 22d All-Union Sci. Session devoted to Radio Day. Sect. on Radio Broadcasting, Electroacoustics and Sound Recording 9 Sep. 1966 p 31-38 refs (See N66-38838 24-07) CFSTI: $2.00

In discussing the operational features of spectrum transformers or compressors for accelerated reading of the signals, two cases are considered: (1) a finite series of signals which are identical in shape after equal time intervals, and (2) a finite series of signals differing in shape after equal time intervals. Equations are formulated to determine the conditions under which the transformed signal spectra for both conditions will show little difference. Results indicate that the condition of simultaneous recording and reading may be used for correctly selecting the transformer parameters; and that the size of the transformation coefficient and the rate of tape passing, which provide the required accuracy, may be estimated.
M.G.J.

N66-38885# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
FAST PERIOD METER WITH INTEGRATED CIRCUITS [TD-METRE RAPIDE A CIRCUITS INTEGRES]
V. Delcroix, M. Henry, J. Lacour, Y. Pinon, A. Tattegrain (Comm. a l'Energie Atomique, Cadarache, France) et al. *In* IAEA Nucl. Electron. 1966 p 185-200 refs In FRENCH; ENGLISH summary (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

The equipment described was designed for measuring the power doubling time of the CABRI reactor during the exponential phase of the transient state produced by a stepwise change in reactivity. The doubling time must be known accurately since it yields the value of excess reactivity introduced and serves as a basis for intercomparison of experiments. The main characteristics of the apparatus are as follows: Detectors: Ionization chambers sensitive to neutrons or gamma radiation. Principle of measurement: The current from the ionization chamber is fed to the input of an amplifier. A fixed threshold at the amplifier output causes the negative feedback resistor R to be replaced by a resistor R/2. Between each passing of the threshold, the chamber current, and thus the power of the reactor, is doubled. A signal of 1 Mc/s from a time-base generator is fed to the counting input register of a high-speed memory made with thin ferromagnetic strips. With each change in range the contents of the register, i.e. the doubling time itself expressed in microseconds, are incorporated in the memory. Measurements ranges: Doubling times from 2 ms to 5 s. Dynamics: Eight doubling times for chamber currents from 10^{-7} to 10^{-5} A. Accuracy: Several times 10^{-3}. Presentation of results: Three intermediate thresholds permit registration of the T/4 values. After each increase in reactor power the print-out unit presents 32 doubling-time measurements to four significant figures (four overlapping measurements per doubling time). Technology: The amplifier, the thresholds, the logical circuits, and most of the control circuits of the thin-strip memory are made with integrated circuits. Switching is carried out by means of field-effect transistors.
Author

N66-38886# Commissariat a l'Energie Atomique, Cadarache (France). Centre d'Etudes Nucleaires.
APPARATUS FOR MEASURING FAST DOUBLING TIMES OF THE CABRI REACTOR [APPAREIL DE MESURE DES TEMPS DE DOUBLEMENT RAPID DU REACTEUR CABRI]

D. Da Costa Vieira, G. Friedling, B. Merite, and A. Tattegrain *In* IAEA Nucl. Electron. 1966 p 201–223 In FRENCH; ENGLISH summary (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

The paper describes an apparatus for measuring doubling times as short as 1 ms in the CABRI reactor. The principal features of the apparatus are: A period measurement range of from 1 ms to 10 s with an accuracy of better than 0.5%; An ionization-chamber current measurement range of 3×10^{-7} to 10^{-5}A; Instant transmission of the results to a point 300 m distant from the reactor. The apparatus includes a constant sensitivity amplifier and several triggering circuits in parallel, the thresholds of which are set at fixed values of 0.3, 0.6, 1.2, 2.4, 4.8 and 9.6 V, and which define five doubling times. The output signals of the triggering circuits are serialized on a single wire, giving a train of six pulses, the intervals between which define the five doubling times. At the reception end a register distributes the stop–go commands of several scalers; there are five scalers of four decades each, counting clock pulses of 1 Mc/s frequency. The apparatus displays the results instantaneously on Nixie tubes and also provides for an automatic print-out on an IBM machine. The paper discusses the principles adopted for the design of the apparatus and lays particular stress on the theoretical accuracy of the measurements. Author

N66-38888# Commissariat a l'Energie Atomique, Paris (France).
THE USE OF MODULATED GAIN DETECTORS AND A DIGITAL DATA STORAGE UNIT TO RECORD PULSED REACTOR EXCURSIONS [ENREGISTREMENT D'EXCURSIONS DE REACTEURS PULSES AU MOYEN DE DETECTEURS A GAIN MODULE ET D'UNE MEMOIRE DIGITALE]
M. Launois *In* IAEA Nucl. Electron. 1966 p 231–244 In FRENCH; ENGLISH summary (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

To ensure accurate recording of pulsed reactor excursions a method has been developed in which use is made of a current detector followed by a sampling circuit, a coder and a digital storage unit consisting at present of an analyser operating as a multiscaler. The original features of this method are: the sampling circuit, which modulates the detector gain by acting on its high-voltage supply and thus limiting its operation to the times when it is in use; a digital coder, located directly on the electrode (anode), which collects the electric charges released in the detection process. Experimental work has been carried out with two types of detector: (1) Photomultipliers, with which a complete circuit has been built up and tested on the CABRI reactor. The author presents the experimental results and discusses the signal/noise relationship, the accuracy (1%) obtained and the stability of the measuring assembly. (2) Fission chambers; description of a test in progress from which similar results are expected. The paper discusses possible and planned applications of this system. Author

N66-38916# India. Dept. of Atomic Energy, Bombay.
A SIMPLE, RELIABLE PRECISION TIME ANALYSER
B. V. Joshi, V. R. Nargundkar, K. Subbario, M. S. Kamath, and S. K. Eligar *In* IAEA Nucl. Electron. 1966 p 645–654 ref (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

A 30-channel time analyser is described. The time analyser was designed and built for pulsed neutron research but can be applied to other uses. Most of the logic is performed by means of ferrite memory core and transistor switching circuits. The analyser described provides channel widths from 10 μs to 10 ms; arbitrarily wider channels are easily obtainable. An input pulse de-randomizer unit using tunnel diodes ensures exactly equal channel widths. A brief description of the principles involved in core switching circuitry is given. The core-transistor transfer loop is compared with the usual core-diode loops and is shown to more versatile and better adapted to the making of a time analyser. The circuits derived from the basic loop are described. The current drivers developed for driving the cores are described. The crystal-controlled clock which controls the width of the time channels and synchronizes the operation of the various circuits is described. The detector pulse derandomizer unit using tunnel diodes is described. The scheme of the time analyser is then described showing how the various circuits can be integrated together to form a versatile time analyser. Author

N66-38918*# AiResearch Mfg. Co., Los Angeles, Calif.
RESEARCH STUDY ON INSTRUMENT UNIT THERMAL CONDITIONING HEAT SINK CONCEPTS First Quarterly Progress Report, 11 Mar.-31 May 1966
R. A. Stone and D. W. Graumann 24 Jun. 1966 52 p refs
Its Rept.-66-0768
(Contract NAS8-11291)
(NASA-CR-78674) CFSTI: HC $3.00/MF $0.50 CSCL 14B

As a basis for the water boiler heat sink module studies, wick heat transfer endurance and wicking rate data were reviewed, and a preliminary design was made of a wick module performance test setup. Analyses of the mechanism and important design parameters of sublimators were conducted, in relation to the water sublimator heat sink module concept. Break pressure for both liquid and vapor breakthrough were also analyzed; results indicate that the breakthrough pressure will always be reached when the interface is at the pore exit. Details are given on a visualization test module designed to study the mechanism of sublimator operation. Observations indicate that there is ice in the pores which melts when the pressure goes above the triple point, allowing water to break through. A series of sketches are included to depict the possible sublimation mechanism when the solid phase is not visible on the liquid side of the plate. M.G.J.

N66-38941*# Barnes Engineering Co., Stamford, Conn.
EARTH/LUNAR HORIZON SENSOR PROGRAM Phase IA Study Report
Frank Schwarz and Thomas Falk 14 Sep. 1965 240 p refs
(Contract NAS9-4962)
(NASA-CR-65531) CFSTI: HC $3.75/MF $1.50 CSCL 20F

Technical aspects of the various types of horizon sensors which may be considered for possible use in the Apollo Extension System space missions are described. Special aspects of sensor technology considered vital to selecting a design goal are presented for the following basic horizon sensor system concepts: conical scan sensors, electronically scanned sensors, and edge trackers. Briefly outlined are: spectral and optical considerations of sensor design, general signal processing concepts relative to the problem of high-precision, horizon edge angular definition, significant characteristics of the various horizon sensor concepts described, and reliability of the various approaches. Also included is a tabulation of the Mean Time Before Failure figures for tentative designs of the three systems which are capable of meeting the program's goals of sensitivity and accuracy. R.L.I.

N66-38942*# Barnes Engineering Co., Stamford, Conn.
EARTH/LUNAR HORIZON SENSOR PROGRAM Addendum to Phase IA Study Report
Frank Schwarz and Thomas Falk 1 Dec. 1965 77 p ref
(Contract NAS9-4962)
(NASA-CR-65532) CFSTI: HC $2.50/MF $0.75 CSCL 20F

A reassessment was made of response time requirements for the Earth/Lunar Horizon Sensor system, and a discussion is presented of performance characteristics of indexed edge trackers, servoed edge trackers, and the electronically sampled thermopile horizon sensor. Of the edge trackers, the field switched tracker was found to offer the greatest advantages in virtually all of the design goal considerations. Calculations show that the field switched edge tracker also provides a considerably better signal-to-noise ratio and accuracy capability than the other systems considered and appears to have the required minimal sensitivity even for a 20 millisecond response time system. R.L.I.

N66-38944*# Barnes Engineering Co., Stamford, Conn.
DESIGN OF FIELD SWITCHED EDGE TRACKING EARTH/LUNAR HORIZON SENSOR SYSTEM Phase IB Report
Frank Schwarz, Thomas Falk, and Peter E. Spangenberg 8 Mar. 1966 52 p
(Contract NAS9-4962)
(NASA-CR-65533; TR-3744-IB) CFSTI: HC $2.50/MF $0.50 CSCL 20F

For use in the earth/lunar horizon sensor system, the optical and mechanical design, the electronic circuitry, and the expected performance characteristics of a field-switching, edge tracker are described. In the field switching technique a field of view at the edge of the planet is compared with an equal field which views a region in space serving as the reference signal. It was concluded that this system can best be implemented through use of thermopile detectors, permitting free choice of the separation of the two fields of view. This results in a simple optical system design and eliminates the need for an optical chopper, bringing about a reduction in size, weight, and power, and greatly increasing the system reliability. R.LI.

N66-39138# Technisch Physische Dienst TNO-TH, Delft (Netherlands).
REPORT OF THE QUALIFICATION TESTS OF TA-7M CAMERA SYSTEM
A. van Milaan, J. Veldman, H. v. d. Stadt, and P. Verburg 12 May 1966 100 p refs *Its* Rept.-66-O-3
(TDCK-45694) CFSTI: HC $3.00/MF $0.75

The technical requirements and the results of a qualification test program for a TA-7M camera system are summarized. Detailed technical information is presented for a complete camera system, which consists of the following parts: three cameras, each having two objectives (f=52mm 1:2.7 and 4=70mm 1:1.6) with a yellow filter; three film magazines; one rate selector; and one speed control box. Schematics complement the analytical data. Test results indicate that the camera and lenses meet the specifications. R.LI.

N66-39154# California Univ., Davis.
SHEAR-STRESS METER TECHNICAL DESCRIPTION, CHAPTER VI
W. B. Goddard *In its* Invest. of Energy, Momentum and Mass Transfer near the Ground Jun. 1966 p 77-82 (See N66-39148 24-30) CFSTI: HC $6.00/MF $1.50

A general description is presented of the 6-meter diameter floating shear-stress lysimeter system used for measuring wind drag force. Emphasis is placed on the shear-stress measuring technique, with details included on calibration procedure, field operations, and data reduction. A.G.O.

N66-39155# California Univ., Davis.
DYNAMIC BEHAVIOR OF THE 50-TON FLOATING SHEAR-STRESS LYSIMETER, CHAPTER VII. PART I: PHYSICAL SYSTEM
W. B. Goddard *In its* Invest. of Energy, Momentum and Mass Transfer near the Ground Jun. 1966 p 83-91 refs (See N66-39148 24-20) CFSTI: HC $6.00/MF $1.50

A model has been developed to describe the shear-stress meter's oscillations, in order to study system optimization and to determine the feasibility of short-time (less than 10-minute) averages. Modes of motion are analyzed, and the system damping factor is considered. Shear-stress meter dynamics are physically described, and the fluid spring constant is examined. Studies have shown that the dynamic oscillations do not appreciably affect the average values of drag force when the averages cover at least 10 minutes. A.G.O.

N66-39156# California Univ., Davis.
STATISTICAL INTERPRETATIONS OF SHEAR-STRESS MEASUREMENTS OF THE FLOATING LYSIMETER SUBJECT TO NATURAL OSCILLATION, CHAPTER VII, PART II
F. A. Brooks, Ruth Laidlaw, F. Jones, and L. A. Smith *In its* Invest. of Energy, Momentum and Mass Transfer near the ground Jun. 1966 p 92-97 refs (See N66-39148 24-20) CFSTI: HC $6.00/MF $1.50

A strip-chart millivoltmeter was used to determine mean magnitudes from the measured, oscillating, horizontal motions of a floating lysimeter. The procedures used in calibrations, and various reduced shear-stress recordings are presented. Consideration is given to the interpretation of short period mean magnitudes of shear stress, and the validity of half-hour means based on sampling intervals as long as 30 seconds. One-minute running mean magnitudes show that the 50-ton float gives consistent 5-minute means for shear stress generated by irregular wind gusts. Statistical study proves that means of widely spaced readings are highly reliable for this oscillating system if based on 60 observations in the averaging period. C.T.C.

N66-39163# California Univ., Davis.
FLOATING LYSIMETER WATER LEVEL MEASURING SYSTEM, CHAPTER XIV
F. J. Lourence and W. B. Goddard *In its* Invest. of Energy, Momentum and Mass Transfer Near the Ground Jun. 1966 p 153-158 (See N66-39148 24-20) CFSTI: HC $6.00/MF $1.50

A detailed description is given of an electronic system which measures the stilling well water height for determining evaporative flux rates from a 20-foot diameter floating lysimeter. The system consists of two units: (1) the float transducer unit located within the lysimeter stilling well, and (2) the recorder-voltage suppressing unit located in a shelter about 200 feet from the lysimeter. The system is capable of operating unattended for several weeks producing a continuous stilling well water level record on a strip chart recorder at a sensitivity nearing 0.001 inches of level change. Diurnal temperature effects appear nil and periodic calibration over a year indicates the system has good stability. C.T.C.

N66-39169# California Univ., Davis.
INSTRUMENT ACCURACY AND EVALUATION, APPENDIX C
F. J. Lourence *In its* Invest. of Energy, Momentum and Mass Transfer Near The Ground Jun. 1966 p 225-226 ref (See N66-39148 24-20) CFSTI: HC $6.00/MF $1.50

A description is given of how maximum validity of field data is achieved by consideration of the following factors: (1) the accuracy and reliability of transducer recording instruments, (2) the calibration accuracy of the field transducers, and (3) the stability of the field transducers with time. A brief discussion is included of cells, platinum resistance thermometers, and resistors which provide the basic measuring and calibration standards. C.T.C.

N66-39172# California Univ., Davis.
AN IMPROVED CUP ANEMOMETER TOTALIZING SYSTEM, APPENDIX F
F. J. Lourence *In its* Invest. of Energy, Momentum and Mass Transfer Near The Ground Jun. 1966 p 239-240 (See N66-39148 24-20) CFSTI: HC $6.00/MF $1.50

A system capable of continuously totalizing pulses from 16 cup anemometers is described. A double set of electro-mechanical counters is the most unique feature of the system. Incoming electrical pulses are automatically switched from one set of counters to another set when a particular counting period has ended. This gives the operator time to accurately write down the pulse totals from each of the counters from the set that has finished totalizing. The counters are then manually reset to zero by the operator. C.T.C.

N66-39173# California Univ., Davis.
CALIBRATION INTERPRETATION OF SPARLING HEATED-ROD ANEMOMETERS INCLUDING CHANGE IN HEATER CURRENT, APPENDIX G
F. A. Brooks, C. L. Sparling, and F. F. Mulholland *In its* Invest. of Energy, Momentum and Mass Transfer Near The Ground Jun. 1966 p 241-246 refs (See N66-39148 24-20) CFSTI: HC $6.00/MF $1.50

The significant design features of heated thermocouple junction anemometers are described, and the behavior theory of these instruments is considered. Calibration coefficients from wind tunnel studies are evaluated, and it is noted that satisfactory performance of the heated-rod anemometer has encouraged the construction of more instruments of this type. A.G.O.

N66-39174# California Univ., Davis.
INFRARED HYGROMETER HUMIDITY SAMPLING SYSTEM AND CALIBRATION, APPENDIX H
F. J. Lourence *In its* Invest. of Energy, Momentum and Mass Transfer Near The Ground Jun. 1966 p 247-253 refs (See N66-39148 24-20) CFSTI: HC $6.00/MF $1.50

Results are presented of calibrations of an infrared hygrometer over a three-year period using several techniques. Improvements and modifications to the instrument are described, and a comparison is given of humidity profiles measured in the field by this system and a wet-dry bulb thermocouple mast. A series of independent calibrations over a two-year period indicate that the hygrometer factory calibration may underestimate water vapor concentration level in the higher humidity regions by 4% to 5%. Tests using psychrometers indicate a 10% to 12% underestimation by the hygrometer in the same region. These discrepancies, it is noted, point out the need for further and more precise calibrations with possible revision of the calibration equation for the hygrometer. A.G.O.

N66-39175# California Univ., Davis.
RADIOMETER CALIBRATION, APPENDIX J
F. J. Lourence and Todd V. Crawford *In its* Invest. of Energy, Momentum and Mass Transfer Near The Ground Jun. 1966 p 255-259 refs (See N66-39148 24-20) CFSTI: HC $6.00/MF $1.50

Calibration techniques are described, and a table of calibration history over the past 5 years of using radiometers is presented. A normal incidence pyrheliometer is briefly mentioned, and the balancing of net radiometers prior to calibration is discussed. Consideration is given to the shading and longwave techniques of calibration with emphasis placed on the indications of sensitivity and accuracy. A.G.O.

N66-39209# Argonne National Lab., Ill. Reactor Operations Div.
A STEADY-STATE DIFFERENTIAL CALORIMETER USED TO MEASURE GAMMA HEATING IN A REACTOR ENVIRONMENT
Dale A. Herbst and James H. Talboy Mar. 1966 31 p refs
(Contract W-31-109-ENG-38)
(ANL-7178) CFSTI: HC $2.00/MF $0.50

The description and operation of a steady-state differential calorimeter designed to measure gamma heat deposited in different samples in reactors are presented. NSA

N66-39249# Argonne National Lab., Ill.
AUTOMATIC SCAN SYSTEM FOR REACTOR-FUEL ASSAY
Thomas H. Busse and Norman S. Beyer Mar. 1966 10 p
(Contract W-31-109-ENG-38)
(ANL-7174) CFSTI: HC $1.00/MF $0.50

The fuel scanner system is an auto-gamma spectrometer with automatic sample changer, automatic x-y scanner, and digital printer. Total system physical and electrical relationships are presented in a block diagram. The scanner is primarily a modified machinist lathe. Results from tests of the system are presented. NSA

N66-39261# Research Inst. of National Defence, Stockholm (Sweden).
SOME INSTRUMENTS FOR NIGHT STUDIES OF UPPER ATMOSPHERE LIGHT EMISSIONS
W. Stoffregen and H. Derblom *In its* Rocket Expt. for Studies of D-Region Ion Concentration and Emission from Released Chem. in Twilight and Aurora 1966 p 100-107 refs (See N66-39251 24-13)

The schematic diagrams, operating principles, and specifications for a spectrophotometer (SP3), photometers (F1 and F2), and an all-sky camera (U-16) used for rocket probe studies of upper atmospheric light emissions at twilight, are presented. A special trailer used to house the instrumentation and the operator, is also described. L.S.

N66-39263# Union Carbide Nuclear Co., Oak Ridge, Tenn.
A GRAVIMETRIC GAS FLOW STANDARD. PART II: PERFORMANCE AND EVALUATION
W. T. Collins and T. W. Selby 15 Apr. 1966 93 p refs
(Contract W-7405-ENG-26)
(R-1632, Pt. II) CFSTI: $3.00

This report describes the performance and evaluation of the Flow Standard. Precision estimates based on the standard deviation of linear fits to flow versus pressure relationships for critically operated flow elements were ±0.035 percent over the range of 0.05 to 1725 grams of dry air per minute. The accuracy of the GGFS was estimated from a rigorous analysis of all known sources of uncertainty. In terms of the standard deviation the uncertainty was calculated to be ±0.15 percent for the flow rate range of 0.06 to 0.3 grams of dry air per minute, and ±0.060 to ±0.065 percent for the flow rates from 0.3 to 1650 grams per minute. The principal sources of uncertainty are discussed and methods proposed for reducing their effect. It was concluded that the gravimetric method has a potential imprecision significantly less than ±0.10 percent standard deviation; and that the concept could be extended for calibrating gas flow rates of several thousand standard cubic feet per minute. Author

N66-39288*# Virginia Univ., Charlottesville. Research Labs. for the Engineering Sciences.
THE DESIGN OF A SKIN FRICTION METER FOR USE IN EXTREME ENVIRONMENTAL CONDITIONS Final Report
James W. Moore, Eugene S. Mc Vey, and William W. Seemuller Aug. 1966 125 p refs
(Grant NGR-47-005-026)
(NASA-CR-78745; EME-4029-103B-66U) CFSTI: HC $4.00/MF $1.00 CSCL 14B

A skin friction meter system and high temperature components have been developed for the direct measurement of skin friction on a hypersonic ramjet in actual flight. The meter is capable of withstandinging the high temperature, high altitude environment withstanding the high temperature, high altitude environment is required. The construction of a low temperature system proved the feasibility of the closed loop system approach. A high temperature torque motor and displacement transducer has been developed with the potential of operating in a 200°F environment. A configuration is proposed in which the motor and transducer are in integral unit. The configuration is adjusted to minimize power dissipation and it is shown that the unit can safely meet the size and torque specifications. Experimentation on a high temperature model suggested the feasibility of using the proposed configuration in the skin friction meter. Author

N66-39303*# California Univ., Berkeley. School of Forestry.
CLOUD COVER INTERFERENCE WITH REMOTE SENSING OF FORESTED AREAS FROM EARTH-ORBITAL AND LOWER ALTITUDES Annual Progress Report
Jerry D. Lent. 30 Sep. 1966. 57 p. refs
(NASA Order R-09-038-002)
(NASA-CR-78742) CFSTI: HC $3.00/MF $0.50 CSCL 14E

Most remote sensing devices do not adequately image the Earth's surface when separated from it by cloud cover. Since few weather stations are located in forested areas, little has been known about the potential limitations of cloud cover for the remoted sensing of forested areas. This study analyzes the cloud cover problem for selecged forested areas in California, including the area in which the NASA Forestry Test Site (the Bucks Lake Test Site) is located. Cloud cover information from several selected meteorological stations in California was interpreted in order to determine its influence on remote sensing applications over forested areas. The question of predicting percent cloud cover at various altitudes was examined by relating recorded ground station observations with representative Earth-orbital cloud imagery. A comprehensive bibliography of recent research on cloud cover conditions, including satellite applications, is included. Author

N66-39304*# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.
THE USE OF MULTISPECTRAL SENSING TECHNIQUES TO DETECT PONDEROSA PINE TREES UNDER STRESS FROM INSECT OR PATHOGENIC ORGANISMS Annual Progress Report
Robert C. Heller, William F. Mc Cambridge, (Rocky Mt. Forest and Range Expt. Sta.), Robert C. Aldrich, and Frederick P. Weber. 30 Sep. 1966. 70 p. refs
(NASA Order R-09-038-002)
(NASA-CR-78741) CFSTI: HC $3.00/MF $0.75 CSCL 02F

Investigations are underway to determine the ground instrumentation, aerial sensing equipment, and techniques required to detect vigor loss and previsual signs of tree mortality caused by bark beetles in coniferous timber stands. Ground and aerial studies have been started and data were collected on spectral reflectance, emissivity, and transpiration of ponderosa pine trees and foliage. Aerial photography (Color and infrared color) was exposed over 11 infested test sites at four time intervals. Optical-mechanical scanning imagery was taken diurnally on 3 days in May and June 1966. Almost 75 percent of the dying trees were not detected until 10 months had elapsed. No difference in interpretation accuracy was found between color and infrared color films but commission errors were slightly more numerous on the infrared color film. Resolution of the thermal imagery was too poor to determine whether thermal differences of stressed trees could be detected from the air. Author

N66-39305*# California Univ., Berkeley.
THE USEFULNESS OF THERMAL INFRARED AND RELATED IMAGERY IN THE EVALUATION OF AGRICULTURAL RESOURCES. AN EXPLORATORY STUDY, VOLUME I Final Report
Robert N. Colwell, John E. Estes, Clifford E. Tiedemann, and James E. Fleming. 30 Sep. 1966. 152 p. refs
(NASA Order R-09-038-002)
(NASA-CR-78740) CFSTI: HC $5.00/MF $1.00 CSCL 02C

Multispectral imagery of the Sacramento Valley of California was studied to determine its usefulness in the inventory and analysis of the cultivated crop resource. The cultivated crops are differentiated by a dichotomous key into six major crop types: orchards, continuous cover crops, row crops, vineyards, irrigated pasture land, and fallow and recently plowed fields. A comprehensive series of selective aerial photo crop identification keys, accompanied by feasibility ratings, is included to facilitate the inventory of the various crops of each major group. It is concluded from this limited study that the inventory and analysis of the cultivated crop resource from imagery flown at optimum specifications is feasible. The results also indicate that no one film-filter combination or image type is best for the evaluation of the various cultivated crop types and conditions. False color photographs can be made by an image enhancement technique which combines the unique spectral signatures of objects from more than one spectral band; thereby increasing the interpretability of the various features of each crop. Author

N66-39306# Tellurometer (Pty.), Ltd., Plumstead (Union of South Africa).
PROCEEDINGS OF THE 1962 TELLUROMETER SYMPOSIUM
[1962] 296 p. refs. Symp. held in London, 29 Jul.–3 Aug. 1962. CFSTI: HC $6.00/MF $1.75

Symposium papers are presented on the uses of Tellurometers in various geographical locations, measurement techniques and procedures, data reduction, and the diversity of applications for microwave distance measurement systems. For individual titles see N66-39307–N66-39330.

N66-39307# Technische Hochschule, Karlsruhe (West Germany). Geodetic Inst.
TWENTY-FOUR HOUR TEST OF TELLUROMETER AT 1-HOUR INTERVALS
H. Draheim. *In* Tellurometer (Pty.), Ltd. Proc. of the 1962 Tellurometer Symp. [1962] 6 p. (See N66-39306 24-14) CFSTI: HC $6.00/MF $1.75

During the testing phase of the Tellurometer MRA-2, a series of observations were made which lasted 24 hours. Tellurometer readings and meteorological data were taken every hour in order to investigate the influence of changing meteorological conditions on the results. The data obtained are presented in graphs and the results are assessed. H.S.W.

N66-39308# Tellurometer (Pty.), Ltd., Plumstead (Union of South Africa).
SOME APPLICATIONS OF ELECTRONIC DISTANCE MEASUREMENT IN PHOTOGRAMMETRIC AND CADASTRAL SURVEYS
V. F. Urban. *In its* Proc. of the 1962 Tellurometer Symp. [1962] 6 p. refs (See N66-39306 24-14) CFSTI: HC $6.00/MF $1.75

Large, medium, and small scale aerial survey methods are described, in which electronic distance measurement techniques were used. Details are given on surveys that were conducted using these techniques, and the results are assessed. Also described are three instruments used in small scale mapping; the airborne profile recorder, the horizon camera, and the Aerodist. Comments are made on the problem of obtaining a truly vertical photograph. It is suggested that masers could be used to solve this problem. H.S.W.

N66-39309# Tellurometer (Pty.), Ltd., Plumstead (Union of South Africa).
THE TELLUROMETER AFLOAT
P. C. Treherne. *In its* Proc. of the 1962 Tellurometer Symp. [1962] 10 p. (See N66-39306 24-14) CFSTI: HC $6.00/MF $1.75

Attempts were made to use the tellurometer at sea and the results obtained are discussed. The first trial was to test the instrument with the boat secured to a bouy and no difficulties were experienced. Several sets of observations were taken at two positions, and all results agreed with those obtained from resection. Readings were also tried with the boat moving at speeds from one to four knots. The procedures found to be most successful in making the observations are described. Both methods appeared to be successful, although it is reported that if observations are made when the boat is moving, one must accept a possible error of up to 2 ft. H.S.W.

N66-39310# Tellurometer (Pty.), Ltd., Plumstead (Union of South Africa).

THE TELLUROMETER AND ITS APPLICATION IN THE DOMAIN OF PETROLEUM RESEARCH

P. Blanchet *In its* Proc. of the 1962 Tellurometer Symp. [1962] 10 p (See N66-39306 24-14) CFSTI: HC $6.00/MF $1.75

The general operating principles of tellurometers are discussed. Essentially, the instrument measures the time taken by one radio wave to travel from a master station to a remote station and return. The maximum range of the instrument varies considerably according to the profile of the ground. Measuring is always possible up to 30 kilometers if the optical sight passes between the two stations. Under exceptional conditions, measurements greater than one hundred kilometers have been recorded. Various applications of the instrument are also discussed, including uses in geodetic surveying, seismic refraction, and in the laying of pipe lines. H.S.W.

N66-39311# Ministry of Transport and Waterways, The Hague (Netherlands).

APPLICATION OF THE TELLUROMETER IN THE NETHERLANDS

D. C. de Bruyn *In* Tellurometer (Pty.), Ltd. Proc. of the 1962 Tellurometer Symp. [1962] 4 p (See N66-39306 24-14) CFSTI: HC $6.00/MF $1.75

Tests conducted with a tellurometer, intended for establishing photogrammetric control in large scale mapping, are discussed. Most of the experiments were made at distances up to a few kilometers with instruments at tripod height. In forest regions, distances could be measured along straight paths, five to six meters wide, to a distance of one kilometer. Additional results are given which point out the accuracy and potential uses of the instrument. Modifications made during the tests are listed and the areas in which the instrument failed are identified. H.S.W.

N66-39312# Directorate of Overseas Surveys, Tolworth (England).

A PROPOSED GRAPHICAL METHOD FOR DERIVING THE REFRACTIVE INDEX OF AIR FOR TELLUROMETER OBSERVATION

J. W. Wright *In* Tellurometer (Pty.), Ltd. Proc. of the 1962 Tellurometer Symp. [1962] 4 p (See N66-39306 24-14) CFSTI: HC $6.00/MF $1.75

It is stated that the computation of the refractive index by the procedure given in the Tellurometer Handbook requires nine operations. A graphical method for making this computation is proposed. The method would be of value to the field user or when results better than one part in a million are not required. H.S.W.

N66-39313# Ministry of National Defence, Brussels (Belgium).

USE OF THE MRA.2 TELLUROMETER

In Tellurometer (Pty.), Ltd. Proc. of the 1962 Tellurometer Symp. [1962] 3 p (See N66-39306 24-14) CFSTI: HC $6.00/MF $1.75

The deficiencies noted after using the tellurometer for eighteen months in the field are listed. These defects were minor and noticed on isolated instruments. It is stated that it would be useful to determine the level of interference that could be borne by the instrument, and to study a system that would enable the user to eliminate, attenuate, or to prevent the harmful effects caused by an external electronic source. H.S.W.

N66-39314# Directorate of Overseas Surveys, Tolworth (England).

FOUR YEARS AND THREE CONTINENTS: SOME EXPERIENCES WITH THE TELLUROMETER IN THE FIELD

A. S. MacDonald *In* Tellurometer (Pty.), Ltd. Proc. of the 1962 Tellurometer Symp. [1962] 9 p refs (See N66-39306 24-14) CFSTI: HC $6.00/MF $1.75

Field experience in the Bahama Islands, Sarawak, and Nyasaland is reviewed to demonstrate the versatility of the tellurometer to provide secondary control for topographic and cadastral purposes in a variety of conditions. The tellurometer's practical operation is discussed as opposed to a consideration of its theoretical performance, and the presentation is directed toward the field operator. Difficulties encountered in the three territories are enumerated, and improvements in design both of the tellurometer and of its accessories are suggested. S.P.

N66-39315# Norges Geografiske Oppmaling, Oslo.

COMPUTATION OF THE RADIUS OF CURVATURE FOR THE TELLUROMETER BEAM AND THE CORRECTIONS DUE TO THE GEOMETRICAL SHAPE OF THE PATH

Geodet S. Bakkelid *In* Tellurometer (Pty.), Ltd. Proc. of the 1962 Tellurometer Symp. [1962] 11 p ref (See N66-39306 24-14) CFSTI: HC $6.00/MF $1.75

Equations are presented for determining the main features of the geometrical shape of the tellurometer beam path. Computations are included for the radius of beam curvature, and corrections to the measured path length S due to its geometrical shape are given. Mathematical expressions are presented for the magnitude and uncertainty of $\triangle$ S. S.P.

N66-39316# Tellurometer, Inc., Washington, D. C.

AIRBORNE DISTANCE MEASURING AND DATA PROCESSING DEVELOPMENTS IN THE UNITED STATES

Claire A. P. Duffie *In* Tellurometer (Pty.), Ltd. Proc. of the 1962 Tellurometer Symp. [1962] 13 p (See N66-39306 24-14) CFSTI: HC $6.00/MF $1.75

Consideration is given to various aspects of airborne distance measurement and the application of data processing and computation to this type of measurement. A brief description of the HIRAN electronic survey system, highlighting those features that led to the development of the SHIRAN system, is presented. SHIRAN is described as a microwave digital geodetic system for performance of first order aerial geodetic surveying, as well as for the establishment of primary and secondary control points for aerial photography. Capabilities of the airborne computer utilizing digital data outputs of the aircraft navigation subsystem, the airborne distance measuring equipment, the terrain profile recording subsystem, and index of refraction equipment are tabulated. S.P.

N66-39317# Royal Danish Geodetic Inst., Copenhagen.

A NOTE ON THE CYCLIC ERROR

Ole Bedsted *In* Tellurometer (Pty.), Ltd. Proc. of the 1962 Tellurometer Symp. [1962] 3 p (See N66-39306 24-14) CFSTI: HC $6.00/MF $1.75

The tellurometer is described as having a zero error dependent of cavity dial setting and a characteristic error termed the cyclic error. An expression for the index error is given as $b_0+b_2 \sin(2\pi 2A/100)$, and methods for determining the components b_0 and b_2 of the index error for all used combinations of tellurometers are considered. S.P.

N66-39318# Royal Danish Geodetic Inst., Copenhagen.

INSTRUMENTAL DEVELOPMENTS OF GEODETIC RADAR SYSTEMS

Knud Poder and Ole Bedsted *In* Tellurometer (Pty.), Ltd. Proc. of the 1962 Tellurometer Symp. [1962] 10 p refs (See N66-39306 24-14) CFSTI: HC $6.00/MF $1.75

The geodetic aspects of using electronic distance measuring instruments—geodetic radar—are mentioned briefly. The tellurometer, and some modifications made to the instrument, are the main subject of the paper. Some desirable improvements are discussed. Finally, some demands to geodetic radar for very long and very short ranges are given. H.S.W.

N66-39319# Royal Danish Geodetic Inst., Copenhagen.
REFLECTIONS
Knud Poder *In* Tellurometer (Pty.), Ltd. Proc. of the 1962 Tellurometer Symp. [1962] 15 p refs (See N66-39306 24-14) CFSTI: HC $6.00/MF $1.75

Formulas describing the ground swing error for simple reflecting surfaces (as the sea) are given. The formulas are approximative. The reflection coefficient of the surface of the sea is in general near unity. The reflection formula shows that the ground swing error is non-sinusoidal. It is, however, possible to apply corrections for this error and attain an accuracy of 0.5–1 mμs. Some methods for the reduction of the magnitude of the reflected signal are discussed. The aims of this paper are to show that measurements over water surfaces need not be much inferior in accuracy, and to enable users of the tellurometer to apply corrections for this error, if suitable siting of the instruments is impossible. Author

N66-39320# Royal Danish Geodetic Inst., Copenhagen.
A LINE-CROSSING EXPERIMENT
Knud Poder and Ole Bedsted *In* Tellurometer (Pty.), Ltd. Proc. of the 1962 Tellurometer Symp. [1962] 6 p refs (See N66-39306 24-14) CFSTI: HC $6.00/MF $1.75

Tellurometer sets were installed at two triangulation stations ashore and onboard a surveying vessel to determine the connection between Norway and Denmark by the line-crossing method. During the measurement, the vessel was navigated over the middle of the line between the two stations. The position of the vessel was determined by measuring horizontal angles between beacons with a sextant; the position was then plotted in the chart with a station pointer. The accuracy was considered sufficient to warrant the line-crossing. The tellurometers on the vessel were operated as masters; the shore sets as remotes tuned on fixed cavity dial settings in order to simplify the operation. The difference between the two types of tellurometer measurements is seen to be 18 cm; deviations of this magnitude are deemed reasonable when a fixed cavity dial setting is used. Although it was concluded that measurements can be made even under some rolling, several modifications for improving the technique are suggested. M.G.J.

N66-39323# Tellurometer (Pty.), Ltd., Plumstead (Union of South Africa).
THE USE OF MODULATED RADIO AND LIGHT WAVES FOR THE MEASUREMENT OF DISTANCE
J. A. Sandover *In its* Proc. of the 1962 Tellurometer Symp. [1962] 19 p refs (See N66-39306 24-14) CFSTI: HC $6.00/MF $1.75

A brief history of the development of the electronic devices used for the measurement of distances is presented, and future trends in the field are assessed in relation to the needs of the civil engineer. The various types of electronic distance measuring devices are summarized, including high, medium, and low frequency systems. The two types of these electronic instruments, employing either radio waves or light waves, are discussed, and their advantages and disadvantages are pointed out. The development of the tellurometer, emphasizing modification and refinement, is outlined, and a summary of tellurometer field work is included. Finally, the electrical system of the tellurometer is described in detail. L.E.W.

N66-39328# Ordnance Survey of Great Britain, Surbiton.
ORDNANCE SURVEY USE OF THE TELLUROMETER FOR CONTROL SURVEYS FOR LARGE SCALE PLANS
R. C. Gardiner-Hill *In* Tellurometer (Pty.), Ltd. Proc. of the 1962 Tellurometer Symp. [1962] 9 p refs (See N66-39306 24-14) CFSTI: HC $6.00/MF $1.75

A method is described for computing the results of tellurometer measurements taken to provide trigonometrical control of large scale plans. The task involved a resurvey of major towns at a scale of 1:1250 or approximately 50 inches to the mile; in these areas it was necessary to supplement the retriangulation by a fourth order triangulation at a density of about one station per mile. Techniques used for semigraphic plotting are summarized, and their advantages cited. It is pointed out that each tellurometer observation can be regarded as establishing that the unknown station lies somewhere on a circle centered on the known station with a radius equal to the tellurometer measurement. Computations are performed in terms of rectangular coordinates on the plane, with a projection scale factor applied to the distance measurements before their tangents are plotted. M.G.J.

N66-39329# Ordnance Survey of Great Britain, Surbiton.
SOME REMARKS ON THE PAPER, REFLECTIONS' BY KNUD PODER
R. C. Gardiner-Hill *In* Tellurometer (Pty.), Ltd. Proc. of the 1962 Tellurometer Symp. [1962] 5 p (See N66-39306 24-14) CFSTI: HC $6.00/MF $1.75

Swing graphs with low, medium, and high reflection coefficients are discussed, in relation to the significant error which is introduced by taking the arithmetic mean of the observations. Figures depicting a swing graph and profile of a measured line are presented as an example of a sinusoidal swing graph. Graphical data are also included to show three typical examples of swing graphs obtained on a line crossing the sea. The average values, obtained in the conventional manner, are shown together with the resultant spheroidal distances. The spheroidal length of this line computed from the existing triangulation is estimated at 29683.096 meters, allowing for the known scale error in the area of 6 p.p.m. This was found to agree well with the theory that the normal procedure of taking the mean gives slightly too low an answer when troughs appear and appreciably too high an answer when there are peaks instead of troughs. M.G.J.

N66-39330# Institut fuer Angewante Geodaesie, Frankfurt am Main (West Germany).
MODIFICATIONS TO TELLUROMETER FOR OPERATION IN POLAR REGIONS
K. Nottarp *In* Tellurometer (Pty.), Ltd. Proc. of the 1962 Tellurometer Symp. [1962] 3 p (See N66-39306 24-14) CFSTI: HC $6.00/MF $1.75

Technical data are given on the modification of the tellurometer for use in polar regions. It is pointed out that polar applications of the tellurometer create three main problems: the tellurometer including its power unit is unsuitable for specialized operation in cold climatic conditions, and the aerial assembly cannot readily be elevated sufficiently high over the ground surface, and it has been found impractical to repair the instruments and calibrate their pattern frequencies. Modifications to the power pack, capacitors, cables, potentiometers, cavity control, separated aerial, power amplifier, parabolic reflector, and test equipment are summarized. L.E.W.

N66-39339*# Chicago Univ., Ill.
ELECTRON MICROSCOPY WITH SUPERCONDUCTING LENSES
H. Fernandez-Moran [1966] 7 p Presented at High Voltage Electron Microscopy Workshop, Summer Session, Argonne, Ill., 14 Jul. 1966
(Grant NsG-441)
(NASA-CR-78745) CFSTI: HC $1.00/MF $0.50 CSCL 20F

Two approaches for improving the design of electron microscopes are reported. High voltage developments are aimed at increasing resolution as well as penetration; this means thicker specimens, useful to both biological scientists and metallurgists. As for the second approach, superconducting lenses operating at cryogenic temperatures are found to give exceptional stability and high resolution; this means sharper electron micrographs at relatively low voltages. Also, this facilitates long exposures at low beam

intensity, which produce fine detail even with relatively large fields. Details on problem area research, industrial and medical applications, and marketing possibilities are included. R.LI.

N66-39386*# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.
THE FEASIBILITY OF IDENTIFYING FOREST SPECIES AND DELINEATING MAJOR TIMBER TYPES IN CALIFORNIA BY MEANS OF HIGH ALTITUDE SMALL SCALE AERIAL PHOTOGRAPHY Annual Progress Report
Donald T. Lauer (Calif. Univ., Berkeley) 30 Sep. 1966 172 p
(NASA Order R-09-038-002)
(NASA-CR-78757) CFSTI: HC $2.00/MF $1.25 CSCL 02F

Identification of forest species in California on high altitude small scale aerial photographs is possible when optimum photographic specifications are utilized. Recognizing tonal and morphological differences occurring between species is directly related to the following factors: film-filter combination, photographic scale, season of year, photo interpretation equipment, film exposure and film processing. Each of these factors has been analyzed and conclusions have been drawn as to the optimum specifications for identification of each of the species studied. A photo interpretation key for the identification of representative stands of several California species has been prepared utilizing aerial photography flown to optimum specifications. Author

N66-39405*# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.
MULTI-SPECTRAL IMAGERY FOR SPECIES IDENTIFICATION
F. P. Weber 30 Sep. 1966 47 p refs
(NASA Order R-09-038-002)
(NASA-CR-78756) CFSTI: HC $2.00/MF $0.50 CSCL 02F

Replicated density readings were taken from line-scan imagery of tree plantations of eight commercially important tree species for four diurnal periods and four seasonal periods. Four spectral regions were used in the comparison: (1) 0.32–0.38 microns, (2) 2.0 to 2.6 microns, (3) 4.5 to 5.5 microns, and (4) 8.2 to 14.0 microns. Standard errors of the mean and coefficients of variation were computed for each species for each wavelength, time of day, and season. The tonal density on the line-scan imagery of each species was ranked by species and the likelihood of separating one tree species from another 19 out of 20 tries ($t=0.05$) was computed. These results are shown in Appendixes "A" and "B". It was found that all four spectral bands were needed to separate all species, one from another. Some species could not be identified, however, even when the four spectral ranges were used in concert. The concept of tree species separation by differing density responses in several channels of the electromagnetic spectrum appears feasible from our findings. Author

N66-39458# Te Co., Santa Barbara, Calif.
ROTATING-IMAGE OPTICAL SCANNER Final Report, Jun. 1965–May 1966
P. S. Sugino and H. P. Wurtz Aug. 1966 79 p refs
(Contract AF 19(628)-5181)
(AFCRL-66-518; AD-637195) CFSTI: HC $3.00/MF $0.75

The unique scanning and encoding technique resulting from this study was made possible by prior work done at The Te Company on a proprietary 4 mirror, coaxial configuration. The final instrument design does provide a means for automatically measuring the solar disk and eclipsed lunar diameters to a precision of 0.1 second of arc by the rotation of a small free running image rotator. Atmospheric errors have been eliminated or minimized by optimization of aperture, scan rate, and spectral band pass. Larger systematic errors, such as arising from diffraction effects have been accepted since they are known functions and can be extracted Author (TAB)

N66-39494# Naval Ordnance Lab., Corona, Calif.
LOW-TEMPERATURE SPECTRAL EMITTANCE MEASUREMENTS
D. L. Stierwalt 15 Aug. 1966 17 p refs
(NOLC-667; AD-637742) CFSTI: HC $1.00/MF $0.50

Instrumentation was developed for measuring the spectral emittance of both transparent and opaque solids from 2 to 50 millimicrons at temperatures ranging from 4.2° to 500°K. The technique was used to study the optical properties of semiconductors, such as germanium, silicon, gallium phosphide, gallium arsenside, gallium antimonide, indium arsenide, and indium antimonide. Measurements were made on materials of use in infrared optics, such as Irtran 1, 2, 3, 4, and 5: glass; quartz; sapphire; and arsenic trisulfide; and on surface coatings and preparations used for thermal control in space applications. The instrumentation is described, and several spectra are shown which demonstrate the information to be gained from this type of measurement. Interpretation of the results is discussed, and the advantages and disadvantages of the method are explained. The relationship between the spectral emittance and the temperature dependence of the total emittance or total absorptance is pointed out. Author (TAB)

N66-39535*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DEVELOPMENT OF SENSORS TO OBTAIN IN-FLIGHT ABLATION MEASUREMENTS OF THERMAL-PROTECTION MATERIALS
Peter J. Le Bel and James M. Russell, III Washington, NASA, Nov. 1966 29 p refs
(NASA-TN-D-3686) CFSTI: HC $2.00/MF $0.50 CSCL 20M

Three instruments to measure the ablative characteristics of thermal-protection materials have been developed by the NASA Langley Research Center. The make-wire sensor is designed to measure the recession of the char-layer interface in a charring ablator and the light-pipe and spring-wire sensors are designed to measure ablator surface recession. The results of extensive ground testing in arc-jet and rocket-exhaust facilities show that each of the three sensors can make ablation measurements to an accuracy in the order of 0.01 inch (0.25 cm). The sensors and associated signal-conditioning circuits have been packaged and environmentally tested to qualify them for use in a spacecraft. Author

N66-39543*# Trident Engineering Associates, Inc., Annapolis, Md.
PROJECT MOON–BLINK Final Report
Washington, NASA, Oct. 1966 79 p refs
(Contract NAS5-9613)
(NASA-CR-630) CFSTI: HC $2.50/MF $0.75 CSCL 03A

Work performed consisted of 1) the development of devices to improve observation of unusual color occurrences on the moon in order to record and identify such phenomena and 2) a lunar surveillance program via telescope employing this especially designed equipment. Trident personnel developed and fabricated a rotating-filter, image-intensification instrument called a "Moon–Blink" device. Using this device they maintained a constant surveillance and observed several color phenomena. The following conclusions were made: (1) Red colorations do appear on the lunar surface. (2) these colorations may persist for several hours. The Trident sighting, on November 15, 1965, lasted at least four hours. Author

N66-39560# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SYSTEM FOR MEASURING THE DRIFT ANGLE AND FLIGHT SPEED OF AIRCRAFT
V. Ye. Kolchinskiy, A. Ye. Chernyy, I. A. Mandurovskiy, and Yu. E. Karev 23 Feb 1966 5 p Transl. into ENGLISH from Soviet Patent No. 168342 (Appl. No. 706357/40-23, 18 Nov. 1965) 2 p
(FTD-TT-65-1739; AD-637387) CFSTI: HC $1.00/MF $0.50

The device for measuring the drift angle and flight speed of an aircraft, based on using the Doppler effect with continuous emission and reception of electromagnetic waves on a four-beam antenna. To increase the accuracy of measuring by simultaneous coherent reception of signals reflected from two sections of the terrain and emitted by two beams of the antenna, and to decrease the weight of the apparatus, one receiving channel is used that is equipped with a computer which serves for polar commutation of the receiving antennas and a transformed signal of the transmitter is used as a voltage heterodyne Author (TAB)

N66-39565# Naval Air Development Center, Johnsville, Pa. Aero-Electronic Technology Dept.
SIGNIFICANCE OF PIEZOELECTRIC CERAMIC AGING IN PASSIVE SONOBUOY APPLICATIONS
J. Dugan 27 Jul. 1966 10 p refs
(NADC-AE-6624; AD-637190) CFSTI: HC $1.00/MF $0.50

Theoretical and experimental results are presented and discussed on the aging problem of piezoelectric ceramic transducers used in passive sonobuoy applications. Author (TAB)

N66-39575# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A CONTRIBUTION TO THE PROBLEM OF CONTROLLING THE IMAGE STEADINESS IN MOTION PICTURE CAMERAS
V. Hyrsl 8 Apr. 1966 20 p Transl. into ENGLISH from Jemna Mech. a Opt. (Prague), no. 7, 1964 p 201-205
(FTD-TT-65-1723; TT-66-62100; AD-637422) CFSTI: HC $1.00/MF $0.50

The article describes and evaluates the means for obtaining picture stability in various types of professional picture cameras, analyzes the sources of picture glittering, and considers the problem of certain arrangements in relation to imperfections of perforation opening. A simple practical method of controlling picture stability characterized by a so-called medium empirical value is described. TAB

N66-39576# Navy Underwater Sound Lab., New London, Conn.
BEHAVIOR OF SMALL ARRAYS AND THE EFFECTS OF UNDRIVEN ELEMENTS SURROUNDING THEM
David T. Porter 25 Jul. 1966 20 p refs
(USL-746; AD-637191) CFSTI: HC $1.00/MF $0.50

Computer results indicate that array behavior is influenced by array size, piston size, and internal impedance of the transducer. The center element of an N-by-N array probably does not have a radiation impedance representative of the average of the array, unless the array is prohibitively large. Also, computer results show that the effects of guard rows of undriven elements surrounding an array decrease as the array becomes larger and as velocity control improves for the array Author (TAB)

N66-39592# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
A UV SPECTROPHOTOPOLARIMETER FOR THE STUDY OF NATURAL SKY BACKGROUNDS Final Report, Dec. 1962-Sep. 1965
Ellis B. Hodgdon and Howard D. Edwards Apr. 1966 203 p refs
(Contract AF 19(628)-2416)
(AFCRL-66-397; AD-637509) CFSTI: HC $6.00/MF $1.25

The report documents the design, construction, and data reduction techniques of a balloon borne ultraviolet Ebert-Sekera spectrophotopolarimeter, whose purpose is to measure the natural sky backgrounds at altitudes greater than 100,000 feet. Considerable detail has been spent in describing the various mechanical, electrical and optical components of the system to serve as a guide for future improvements and alterations of the instrument. The data reduction section describes the various computer programs that have been necessary in order to reduce the large amount of data that is obtained. Intensity data at altitude has not been obtained as of yet, but the system has been shown to be capable of giving intensity and the Stokes parameters of the incident light Author (TAB)

N66-39652# General Dynamics Corp., Groton, Conn. Research and Development Dept.
TRANSDUCER SHOCK STUDY, PHASE II
A. D. Carlson and R. J. Mc Grattan 23 May 1966 40 p ref
(Contract N70024-1382)
(U411-66-031; AD-637271) CFSTI: HC $2.00/MF $0.50

A shock analysis of a sonar transducer was conducted in AD-631 344. This report presents the results of a parametric study to optimize the shock resistance of the transducer. The explosion forces are considered as a hydraulic shock along the axis of the transducer and a mechanical shock normal to this axis. Results of the study indicate that relatively simple modifications can be made to this transducer to significantly improve both its mechanical and hydraulic shock resistance. (Author) TAB

N66-39698*# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.
THE USE OF HIGH ALTITUDE, COLOR AND SPECTROZONAL IMAGERY FOR THE INVENTORY OF WILDLAND RESOURCES. VOLUME II: THE RANGE RESOURCE Annual Progress Report
David M. Carneggie, Edwin H. Roberts, and Robert N. Colwell (Calif. Univ., Berkeley) 30 Sep. 1966 70 p refs
(NASA Order R-09-038-002)
(NASA-CR-78879) CFSTI: HC $3.00/MF $0.75 CSCL 02F

High altitude multispectral imagery of annual and perennial rangeland in the Sierra Nevada, Cascade Mountains, and foothills of the Coast Range of California was studied to determine the ease and accuracy of identifying and mapping important range characteristics. Further consideration was given to the time or season for obtaining imagery that would yield the greatest quantity of useful information. Preliminary analysis indicated that no one film-filter combination or image type was best for identifying all significant features. However, considerably more information was obtained from interpretation of two or more spectral bands in concert. Ekta Aero infrared film appeared to be the most useful single film-filter combination. In addition, thermal infrared and K-band radar imagery were obtained and their usefulness in making forage inventories is discussed. The objective of this feasibility study was to provide for eventual use of imagery to be obtained from manned earth-orbiting vehicles. S.P.

N66-39715*# California Univ., Berkeley.
THE USEFULNESS OF THERMAL INFRARED AND RELATED IMAGERY IN THE EVALUATION OF AGRICULTURAL RESOURCES. AN EXPLORATORY STUDY, VOLUME II Final Report
Robert N. Colwell, John E. Estes, Clifford E. Tiedemann, and James E. Fleming 30 Sep. 1966 93 p refs Prepared for Pacific Southwest Forest and Range Expt. Sta.
(NASA Order R-09-038-002)
(NASA-CR-78863) CFSTI: HC $3.00/MF $0.75 CSCL 02C

Multispectral imagery of selected test areas in California was studied to determine its usefulness in the inventory and analysis of the livestock, soils and water resources. Optimum specifications and recommendations are presented for a reliable inventory of livestock through the use of conventional aerial photography. In doing so, the season for obtaining useful imagery, the optimum scale of imagery and the usefulness of each film or image type is illustrated and discussed. Additionally, a comprehensive series of selective aerial photo identification keys, accompanied by feasibility ratings, is included to facilitate the inventory of animal types and animal breeds. Also discussed are the applications of remote sensing technology for the inventory

and analysis of the soil and water resources. A discussion of the adaptiveness and usefulness of a multispectral approach to the evaluation of these resources is presented with selected illustrations. Author

N66-39763# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INSTRUMENT FOR DETECTING DEFECTS IN THE SUBSURFACE LAYER OF A NONMAGNETIC METAL
A. N. Yermakov, V. V. Panasyuk, and A. Ya. Teterko Apr. 1966 22 p refs Transl. into ENGLISH from Publ. "LVIV Mashini i Pribori dlya Ispitanii Metallov" Kiev, 1961 p 116–127
(FTD-MT-65-18; TT-66-62068; AD-637372) CFSTI: HC $1.00/MF $0.50

The paper describes an instrument which permits the detection of microinhomogeneities or disturbances of continuity in the surface or subsurface layer of a nonmagnetic metal, i.e., surface and subsurface cracks, cavities, nonmetallic inclusions, and others. With appropriate calibration the instrument can also be used for determining the intensity of workhardening of the surface of a nonmagnetic metal. The measurement method is based on the determination of the anisotropy of electrical resistance in two mutually perpendicular directions passing through a given point of the metal. (Author) TAB

N66-39773# Block Engineering, Inc., Cambridge, Mass.
HIGH TEMPERATURE GAS REFRACTOMETER Final Scientific Report, 1 Feb. 1965–1 Jul. 1966
Uri P. Oppenheim Jul. 1966 35 p refs *Its* Rept.-9210
(Contract AF 19(628)-4356)
(AFCRL-66-507; AD-637235) CFSTI: HC $2.00/MF $0.50

A refractometer was designed and constructed for the measurement of the optical dispersion of gases at temperatures up to 1000°C. It consisted of a Michelson-type interferometer, in which both arms were enclosed in a furnace. The whole assembly was enclosed in a vacuum. The refractometer could be operated in the visible and near infrared regions of the spectrum. The pressure range of the sample gases was between vacuum and several atmospheres. Author (TAB)

N66-39783# Washington Univ., Seattle. Dept. of Atmospheric Sciences.
LIQUID FILM HYGROMETRY Final Scientific Report, 1 Feb. 1964–31 Jul. 1965
Robert J. Charlson, K. J. K. Buettner, and G. A. Maykut Mar. 1966 24 p refs
(Contract AF 19(628)-303)
(AFCRL-66-244; AD-637588) CFSTI: HC $1.00/MF $0.50

The report summarizes the final phase of development of a liquid film hygrometer. This instrument, which senses the partial pressure of water vapor of a sample gas flow, utilizes a heterogeneous mixture of a hygroscopic liquid coated on the surface of an inert granular solid as the dielectric of a capacitor. The resulting hygrometer has proven to be hysteresis-free and has a theoretically predictable behavior. Results of field tests with an engineering model are presented and discussed. Attempts to increase the sensitivity below the present 0.1 mb level are described and limitations in circuit design pointed out. Capabilities of the device are summarized. The reader is referred to Scientific Reports No. 1 (AD-406 876) and No. 2 (AD-604 340) for theoretical and technical details of the liquid film hygrometer Author (TAB)

N66-39844# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.
SYMMETRICAL BACK-REFLECTION FOCUSING CAMERA COMBINED WITH X-RAY MICROFOCUS TUBE
Z. Baran and A. Stanek Mar. 1966 15 p refs
(INR-697/XIV/PS) CFSTI: HC $1.00/MF $0.50

The symmetrical back-reflection focusing camera combined with X-ray microfocus tube is described in which the exposure time has been very much reduced, simultaneously high resolution of the CuK α doublet has been obtained. This camera has the advantage for precise lattice parameter measurements of powder specimen or metallographic specimen. Author

N66-39886*# Giannini Controls Corp., Duarte, Calif. Control/Nucleonics Div.
DESIGN OF A SOFT X-RAY ABSORPTION-MODE GAS DENSITY MEASURING SYSTEM
David B. Hakewessell 18 Jul. 1966 87 p refs
(Contract NAS1-5577)
(NASA-CR-66167) CFSTI: HC $2.50/MF $0.75 CSCL 14B

A soft X-ray absorption-mode gas density measuring system has been developed which operates on the principle that the quantity of soft X-rays absorbed in a gas is a function of the gas density. System operating parameters have been selected which provide a measurement accuracy of ±5% of density over a range of 0.01 atmosphere to 1.0 atmosphere, with measurement path lengths of 2.5 to 61 cm. A prototype system has been assembled, calibrated, and tested and is ready for installation in gas-flow facilities needing this measurement capability. Author

N66-39900*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EVALUATION OF CROSS-POINTER-TYPE INSTRUMENT DISPLAY IN LANDING APPROACHES WITH A HELICOPTER
William Gracey, Robert W. Sommer, and Don F. Tibbs Washington, NASA, Nov. 1966 47 p refs
(NASA-TN-D-3677) CFSTI: HC $2.00/MF $0.50 CSCL 17G

An evaluation of a landing-approach instrument display incorporating a cross-pointer presentation has been conducted in landing-approach tests with a helicopter. The display consisted of a vertical vertical-situation–flight-director indicator, a horizontal-situation indicator, and small vertical-scale instruments for the presentation of airspeed, ground speed, vertical speed, range, and height. The tests of the display were conducted under simulated instrument flight rules conditions along a 6° glide slope at approach speeds of 30 and 60 knots. The results of tests of four configurations of the attitude-guidance elements of the display showed that course guidance information in the form of control-command (flight-director) signals provided more precise control of course than that provided by course-deviation and ground-track angle information. With the best of the four configurations of slope guidance information, satisfactory guidance along a 6° glide slope could be maintained at airspeeds below that for minimum power. Using the best display of course and slope guidance, one pilot flew twenty (out of twenty-two) 30-knot approaches (in head, cross, and tail winds) to a successful 50-foot (15.24 meters) breakout and visual slowdown to hover. The success of these approach tests, however, can be considered as only a partial indication of the operational suitability of the test display. Author

N66-39917*# Douglas Aircraft Co., Inc., Newport Beach, Calif. Astropower Lab.
RESEARCH ON THE UTILIZATION OF PATTERN RECOGNITION TECHNIQUES TO IDENTIFY AND CLASSIFY OBJECTS IN VIDEO DATA Technical Progress Report No. 3, 20 May–29 Jul. 1966
G. E. Axtelle et al Aug. 1966 71 p refs
(Contract NAS12-30)
(NASA-CR-79123; SM-48464-TPR-3) CFSTI: HC $2.00/MF $0.75 CSCL 14E

This report covers the NIMBUS cloud pattern experiments and spaceborne recognition processor feasibility studies. The NIMBUS experiments lead to the conclusion that two of the pattern recognition system design techniques appear to have significant

advantages over those previously studied. The best techniques achieved performance levels of about 90%. Although higher performance is desirable for an operational system, the levels achieved are compatible with the number and quality of the sample patterns used, and the minimal extent of the preprocessing considered. The feasibility of two parallel/analog implementations of a spaceborne recognition processor was investigated. Although operationally feasible, both systems suffer from the requirement for excessive power and weight as a result of the restriction to consider off-the-shelf components only. Serial/digital approaches are suggested. These latter approaches will not present weight or power difficulties, but need to be studied to determine whether or not processing time is commensurate with the parallel analog configurations. Author

N66-39923*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ANALYSIS OF CADMIUM-CADMIUM COULOMETERS USED FOR CHARGE CONTROL IN NICKEL-CADMIUM SPACE BATTERIES
Eugene R. Stroup Sep. 1966 17 p
(NASA-TM-X-59021; X-716-66-462) CFSTI: HC $1.00/MF $0.50 CSCL 10C

Coulometers have been designed, developed, and shown to be acceptable for controlling the charging of Nickel-Cadmium spacecraft batteries. Two coulometer manufacturers have demonstrated a capability to construct and deliver operational units that are space qualified and tested to flight specifications. The incorporation of this device in the space battery control system reduces the rate of overcharging; it produces a voltage signal when the battery charge has been restored so the charge can be interrupted or reduced, and thus eliminates the heat dissipation which would result from unnecessary overcharging. This improves the voltage characteristics and lengthens the life of the battery. Author

N66-39924*# Douglas Aircraft Co., Inc., Newport Beach, Calif. Astropower Lab.
RESEARCH ON THE UTILIZATION OF PATTERN RECOGNITION TECHNIQUES TO IDENTIFY AND CLASSIFY OBJECTS IN VIDEO DATA Technical Progress Report No. 2, 1 Oct. 1965–20 May 1966
Jun. 1966 56 p refs
(Contract NAS12-30)
(NASA-CR-79109; SM-48464-TPR-2) CFSTI: HC $3.00/MF $0.75 CSCL 14E

Experimental results obtained on features of the lunar terrain are summarized as follows: (1) The quadratic property filters (DAID units) provided significantly higher performance levels than the linear property filters (SDA units), although the total number of adjustable parameters in the specification of the units was about the same for both property filter sets. (2) When the generalization performance was low, Bayes weights and forced learning gave the best results with the DAID units. At intermediate performance levels, all of the techniques were approximately equal. At performance levels high enough for an operational system, iterative design was the top performer. (3) The poor performance of the MADALINE appears to be due to the inefficiency of the algorithm coupled with the limitation on the design time. (4) The performance obtained appears to be very strongly related to the size of the significant pattern features relative to the size of the sensory field. When the significant feature represents less than 1% of the field, the best generalization performance achieved was 64%. When the feature was 5 to 10% of the field, the best generalization was 76%. With features covering 30% of the field, the generalization performance better than 99% was achieved. Author

N66-39929*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RANGER IX PHOTOGRAPHIC PARAMETERS
W. E. Kirhofer and D. E. Willingham 15 Sep. 1966 164 p refs
(Contract NAS7-100)
(NASA-CR-79183; JPL-TR-32-966) CFSTI: HC $3.25/MF $1.00 CSCL 14E

Photographic parameters necessary for detailed interpretation of the *Ranger IX* pictures are listed for selected photographs, including all photographs published in the *Ranger IX* atlases. Parameter accuracies and the method of data generation are discussed. Author

N66-39938*# National Research Corp., Cambridge, Mass. Research Div.
DEVELOPMENT OF A MASS SPECTROMETER DESIGN Final Report, Jun. 1, 1964–Dec. 31, 1964
P. Blum and F. L. Torney, Jr. 23 Mar. 1965 67 p refs
(Contract NAS1-2691-6)
(NASA-CR-66201) CFSTI: HC $2.50/MF $0.75 CSCL 20F

Purpose of the program is to develop a cold cathode ion source mated to a quadrupole mass spectrometer. The completed unit is to be used as a residual gas analyzer. The cold cathode (magnetron) ion source was chosen because of lower background noise and higher sensitivities than the usual hot-filament types. The design of the ion source and the mass spectrometer, and the construction and experiments with the ion source are described in detail. Author

N66-39941*# Measurement Analysis Corp., Los Angeles, Calif.
STUDY OF CROSS-CORRELATION SYSTEMS ANALYSES Final Report, Jun. 29, 1965–Aug. 31, 1966
R. D. Kelly Sep. 1966 12 p refs
(Contract NAS8-20179)
(NASA-CR-79106; MAC-511-10) CFSTI: HC $1.00/MF $0.50 CSCL 14C

This is a final management summary of the results obtained for the contract. The goals of the contract were to (1) survey available hardware for acquisition and analysis of dynamic pressure data for wind tunnel and flight measurements; (2) study errors associated with practical analysis equipment; and (3) select equipment for dynamic pressure measurements and evaluate the accuracy of the procured hardware. The results are presented in form of 13 brief summaries of documents that were isued under the contract. K.W.

N66-39986*# Parametrics, Inc., Waltham, Mass.
ULTRASONIC TEMPERATURE MEASURING DEVICE Fifth Quarterly Progress Report
L. C. Lynnworth and E. H. Carnevale Oct. 1966 18 p refs
(Contract NAS3-7981)
(NASA-CR-92101) CFSTI: HC $1.00/MF $0.50

Thirty wire samples of seven different refractory elements and alloys were irradiated. Subsequently, the effect of radiation on the sound velocity-temperature relationship will be determined. Materials have been reviewed with respect to sensor and sheath applications. It appears that pure Re is the preferred sensor, and tungsten, the preferred sheath, for use in graphite up to at least 4500°R. Other combinations are required for possible use to 5000°R and above, depending on time at temperature, etc. The automatic ultrasonic thermometer instrument has been tested with Re, W and Mo wires heated up to about 4200°R, with satisfactory results. Author

N66-40000*# Pennsylvania State Univ., University Park.
ENHANCING EFFECTIVE INSTRUMENT RESOLUTION BY AN ANALOG METHOD Scientific Report no. 280

M. F. Zabielski 30 Sep. 1966 47 p refs
(Grant NgR-39-009-032)
(NASA-CR-79099) CFSTI: HC $2.00/MF $0.50 CSCL 14B

An analog device which is capable of enhancing the effective resolution of certain analytical instruments is described. This enhancement is effected by the mathematical operation of deconvolution. An improvement in resolution by a factor of six has been achieved. This device is also capable of computing the convolution integral which is used to describe the effects of various instrument parameters on instrument performance. The theory of operation of this device is given and information sufficient for construction and operation is supplied. Examples of results obtained in several typical situations are presented. Author

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N66-38829# Tokyo Univ. (Japan). Dept. of Aeronautics.
BOUNCING OF VALVES
Fujio Nakanishi *In its* Selected Papers of F. Nakanishi Jun. 1966 p 244–248 (See N66-38806 24-32) CFSTI: HC $7.00/MF $1.75

Vibration characteristics of valve mechanisms and the bouncing condition of valves are investigated. It is pointed out that the phase angle of vibration in the first acceleration period has a serious effect. The valve mechanisms for a constant acceleration cam and for a cam with sudden acceleration are analyzed. It was concluded that there is less bouncing with the constant acceleration cam. N.E.N.

N66-38831# Tokyo Univ. (Japan). Dept. of Aeronautics.
PIEZO-ELECTRIC INDICATOR FOR HIGH SPEED INTERNAL COMBUSTION ENGINES
Fujio Nakanishi *In its* Selected Papers of F. Nakanishi Jun. 1966 p 253–257 (See N66-38806 24-32) CFSTI: HC $7.00/MF $1.75

The application of a piezoelectric quartz indicator to study the condition of working gas changes in the cylinders of a reciprocating engine is described. A diagrammatic sketch and typical curves for plate and grid currents are included. The grid voltage, plate current, and pressure in the cylinder are discussed for the stroke cycle. N.E.N.

N66-38832# Tokyo Univ. (Japan). Dept. of Aeronautics.
A NEW HIGH SPEED INDICATOR FOR INTERNAL COMBUSTION ENGINES
Fujio Nakanishi *In its* Selected Papers of F. Nakamishi Jun. 1966 p 258–270 (See N66-38806 24-32) CFSTI: HC $7.00/MF $1.75

An electro-optical indicator to measure pressure in the pistons is described. The principle of operation, the optical system, and the various vibration measurements are mentioned. The construction of the indicator and the recording camera are outlined, and examples of pressure diagrams are included. N.E.N.

N66-38864*# North American Aviation, Inc., Los Angeles, Calif.
RESEARCH AND DEVELOPMENT FOR FABRICATING A SIMULATED TITANIUM ALLOY Y-RING SEGMENT FOR THE S-IC FUEL TANK Phase I and II Report, 30 Jun. 1965–11 Feb. 1966
T. E. De Witt et al [1966] 118 p refs
(Contract NAS8-20533)
(NASA-CR-78668; NA-66-104) CFSTI: HC $4.00/MF $1.00 CSCL 13H

Design details are given on a 8Al-1Mo-1V titanium alloy head-cylinder-skirt attachment for the S-IC fuel tank; roll diffusion bonding and optimized machining techniques were used. Processing methods, including diffusion bonding, machining, chemical milling, hot forming, thermal treatment, and related processes required for fabricating the full scale Y-ring segments were developed using subscale test components. A complete evaluation of these test components was also made. Tooling required for fabrication and inspection is discussed. A study of the effects of isothermal aging time and temperature on sharp notch properties of Ti-8Al-1Mo-1V, and a statistical analysis of the relationship between the sharp notch and yield strength of this alloy are also reported. S.C.W.

N66-38917*# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
RELATIONSHIPS BETWEEN WELD QUALITY AND NON-VACUUM ELECTRON BEAM WELDING PROCEDURES Technical Progress Summary Report, 15 Jun. 1965–15 Feb. 1966
F. D. Seaman [1966] 89 p refs
(Contract NAS8-11929)
(NASA-CR-78673) CFSTI: HC $3.00/MF $0.75 CSCL 13H

Critical procedure details for nonvacuum electron beam welds have been identified and related to such qualities as undercut, beam width, contour, and porosity. Welds that are consistent with actual quality standards have been produced. The strength of one-side welds produced at 3.6 kW power (approximately 28 kilojoules-heat input/unit length per unit thickness) followed the heat input strength relationship and were equivalent to GTA welds. Welds of similar cross section but produced at lower unit heat levels (16–18 kilojoules) had similar strength. Slightly narrower welds (produced at maximum speeds for the small 10 kVA welder and representing 12 kilojoules per unit of weld) showed proportionate increases in strength. The work reported has been accomplished on .250 inch 2219-T87 using a 10 kVA welder. Author

N66-38920*# North American Aviation, Inc., Los Angeles, Calif.
DEVELOPMENT OF NONDESTRUCTIVE TESTING TECHNIQUES FOR HONEYCOMB HEAT SHIELDS Annual Report, 1 Jul. 1965–31 May 1966
J. F. Moore and George Martin Jul. 1966 182 p refs
(Contract NAS8-11733)
(NASA-CR-78681; NA-66-638) CFSTI: HC $5.00/MF $1.25 CSCL 13H

Literature and industrial survey results are reported in terms of ultrasonic inspection standards and specifications, and Saturn honeycomb defect characterization. In general, it was concluded that standards for honeycomb composites must be prepared from actual vehicle components with prescribed defects designed from performance design allowables. A survey on the factors affecting adhesive bond strength and the mechanisms that weaken or fail in an adhesively bonded joint indicates that cohesive bond failures are typical of the majority of composite failures Adhesive bonded lap shear and honeycomb specimens were fabricated and evaluated, with several prepared under varying cure conditions to provide a basis for statistical correlation with bond strength. Experimental vibration tests on degraded honeycomb adhesive bonds showed a qualitative relationship between vibrational response and adhesive bond strength. Impedance system evaluation included significant sensitivity improvement by impedance matching the crystal to the composites. Also discussed is an experimental breadboard system which showed a capability of discriminating between various strength bonds. M.G.J.

N66-39017# Joint Publications Research Service, Washington, D. C.

CONTACT WELDING OF VAD-23 ALLOY

A. I. Pugachev and M. N. Pastukh. *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 97–105 (See N66-39006 24-17) CFSTI: $7.30

In its naturally aged state, VAD-23 alloy can be treated by contact spot welding and seam welding; and conditions required are about the same for VAD-23 and D-16, alloys of the Al–Cu–Li–Cd–Mn system. Shear and tear away stress and coefficient of plasticity in welded points of 2 mm sheets are 10 to 15% higher in VAD-23 than in D-16; and mechanical properties in the natural state are about the same for both alloys. Welds are better for D-16 when the two alloys are treated in their artificially aged states. For both, weldability decreases as sheet thickness increases. A method is presented for calculating welding condition parameters so that satisfactory stability can be obtained for spot welded points in artificially aged VAD-23. M.W.R.

N66-39036# Joint Publications Research Service, Washington, D. C.

PRODUCTION OF SAP-1 SHEETS FOR WELDING BY ROLLING IN A REEL

V. G. Kovrizhnykh, A. A. Vorob'yev, Yu. N. Ponogaybo, N. D. Tsabrov, and B. I. Matveyev. *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 292–309 (See N66-39006 24-17) CFSTI: $7.30

Industrial-size sheets from a high strength alloy, designated as SAP-1 (sintered aluminum powder), were produced by rolling in a reel using blanks made by stamping on a hydraulic press. The sheets were weldable; and it was found that vacuum annealing could be replaced by prolonged high temperature annealing to produce sheets as wide as 1400 mm and as long as 7000 mm. Production of briquets weighing as much as 500 kg from the SAP-1, the structure and property of sheets produced by hot and cold rolling, and the possibility of increasing the plasticity of the alloy sheets are discussed. M.W.R.

N66-39037# Joint Publications Research Service, Washington, D. C.

ARGON ARC WELDING OF THE SAP REFRACTORY MATERIAL

V. I. Oboturov. *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 310–315 (See N66-39006 24-17) CFSTI: $7.30

An argon arc welding method is proposed to obtain high quality welded joints from SAP (sintered aluminum powder) alloy sheets, which were produced from briquettes and subjected to high temperature annealing. Strength of SAP-1 joints produced at room temperature during manual argon arc welding with AMg6 welding wire is 94% that of the base material; and for SAP-2 joints under these conditions, it is 90%. At 500°C, SAP-1 welded joints contain 97% the strength of the base metal. Mechanical properties of the welded joints are tabulated, and several photographs of the welds are included. M.W.R.

N66-39038# Joint Publications Research Service, Washington, D. C.

RIBBON REELING OF ALUMINUM POWDER IN THE REELED RIBBONS WITH DENSE RIBBONS

L. S. Baykova, V. A. Onopriyenko, G. F. Tikhanov, and V. G. Khronov. *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 316–322 (See N66-39006 24-17) CFSTI: $7.30

Ribbon stock of not less than 10 mm in length and between 1 and 1.7 mm in thickness was produced by continuous rolling of finely dispersed aluminum powder; and, because the usual 15 to 20 mm trimming on each side of the ribbon is not necessary, the yield of useable material is increased. A ribbon stock approximately 1 mm thick can be successfully rolled on a drum with a radius of at least 225 mm. For rolling on 180 mm dia reels, a special regulating device limits the angle of entrapment of the powder by the rollers, and the consequent flow of the powder into the rolling zone. A test batch was produced by winding on 160 mm dia reel. The aluminum powder used contained 6.7 to 6.9% aluminum oxide, 0.15% iron, and 0.2% fats. M.W.R.

N66-39039# Joint Publications Research Service, Washington, D. C.

PRODUCTION OF THIN WALLED PIPES FROM SAP BY THE COLD PRESSING METHOD

A. N. Kuznetsov, G. G. Epshteyn, and P. V. Kishnev. *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 323–330 (See N66-39006 24-17) CFSTI: $7.30

Cold pressing with lubrication is used to produce thin-walled small diameter SAP (sintered aluminum powder) pipes; and the ends of these pipes can be locked without heating. For a 14×1 mm SAP-1 pipe, with extension, specific pressure during drawing is found to be equal to 120 to 130 kg-force/mm^2; and since pressing can take place at the rate of 2 to 4 m/sec, the use of rapid hydraulic or mechanical presses is recommended. Since both pipes and work blanks heat to at least 400° or 460°C during pressing, the pressure required is lowered. While the microstructure of the cold pressed pipes is not clearly striated, a striated structure is developed after drawing. The developed method is considered desirable because it shortens the production cycle, decreases the number of rejects, and increases productivity of labor. M.W.R.

N66-39040# Joint Publications Research Service, Washington, D. C.

PRODUCTION PROPERTIES AND STRUCTURE OF HOT PRESSED AND ROLLED PIPES FROM SAP

P. V. Kishnev and V. A. Shelamov. *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 331–338 refs (See N66-39006 24-17) CFSTI: $7.30

Industrial technology is discussed for the production of hot pressed SAP-1 (sintered aluminum powder) pipes that meet the technical specifications required for aluminum alloy pipes. When the briquets are annealed at between 660° and 680°C, the ends of the pipes can be braced without destruction or crackling. The pipes are then welded by fusion, and their degree of deformation and rate of cold rolling are increased. Mechanical properties of circular and other pipes produced from SAP-1, which has between 6 and 9% Al_2O_3, are sufficiently stable. M.W.R.

N66-39048# Joint Publications Research Service, Washington, D. C.

PRODUCTION OF PRESSED SEMIFINISHED PRODUCTS FROM AD31 ALLOY

N. M. Edel'man, N. I. Vasil'veva, and Z. I. Starostina. *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 398–407 (See N66-39006 24-17) CFSTI: $7.30

Technology is proposed for the production of high quality shapes, including thick-walled and complex configurations, from AD-31, an alloy of the Al-Mg-Si system. Temperature of ingot during pressing should be on about 480° to 500°C, and container temperature at least 400° to 420°C. Prior to tempering, temperature should be 520°±5°C, and holding time should not exceed 10 to 20 min. Deformation in shapes undergoing straightening on stretching machines should not exceed 4%, and the natural aging should be conducted at 165°±5°C for 10 hr. Fine grain materials and good decorative appearance result in materials produced under these conditions. M.W.R.

N66-39049# Joint Publications Research Service, Washington, D. C.

THIN WALLED PIPES FROM M40 ALLOY

Ye. F. Chirkov and I. I. Simanova *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 408–419 (See N66-39006 24-17) CFSTI: $7.30

Optimum technological conditions were established for pipes produced from the deformable aluminum alloy M40 by the cold rolling method of pressed workblanks. These conditions include: pressing of intermediate diameter pipes (54 to 48 mm) at 415° to 435°C, a pressing rate of 1m/min, annealing, cold rolling at 41×38 mm diameter, the feeding rate (10 to 14 mm double step of the rolling mill cage), tempering at 508°±3°C, calibration, and mechanical straightening. Thin walled pipes were obtained with a tensile strength of 48 to 49 kg-force/mm^2, a yield point of 33 to 34 kg-force/mm^2, and relative elongation of 16% to 17%. It was found possible to cold roll M40 pipes at higher feeding rates and not affect the mechanical properties. Optimum conditions were also selected for artificial aging at 175°C for 16 hours. From microstructure studies it was shown that the mechanical properties of the leading and trailing ends of thin walled pipes differ slightly in the direction of rolling and in the direction normal to rolling. N.A.S.

N66-39105# Marine Engineering Lab., Annapolis, Md.
FRICTION AND WEAR OF COMPOSITE LUBRICATING MATERIALS
G. L. Thomas Jul. 1966 21 p refs
(MEL-28166; AD-636402) CFSTI: HC $1.00/MF $0.50

Solid lubricants present a solution in some applications to the need for safe, effective lubrication in the higher temperature and pressure ranges demanded by Navy machinery. Friction and wear characteristics of self-lubricating-type composite materials have been evaluated for potential high-pressure air compressor application using a bench-scale apparatus. A few of the materials have been used successfully in a nonlubricated cylinder seal application. Author (TAB)

N66-39177# Union Carbide Nuclear Co., Oak Ridge, Tenn. Nuclear Div.
A SPECIAL MACHINE TOOL SLIDE BEARING MATERIAL
Charles Asmanes 20 Jul. 1966 14 p
(Contract W-7405-ENG-26)
(Y-1547) CFSTI: HC $1.00/MF $0.50

Many machine tools at the Oak Ridge Y-12 Plant have been equipped with Teflon wear pads under the slides. The material has minimized the amount of maintenance work and eliminated troublesome lubrication problems. Teflon is easily applied to machine ways, usually by clamping the material under the wiper pads. Author (NSA)

N66-39426# Joint Publications Research Service, Washington, D. C.
SOVIET ELECTRON-BEAM TECHNOLOGY
21 Sep. 1966 18 p refs Transl. into ENGLISH from selected Russian periodicals, 1965–1966
(JPRS-37746; TT-66-34174) CFSTI: $1.00

CONTENTS:

1. EFFECT OF ULTRASONIC VIBRATIONS ON THE STRUCTURE OF MOLYBDENUM SUBJECTED TO ELECTRON-BEAM MELTING G. F. Zaboronk, V. B. Milova, M. D. Polyakova, and T. V. Simonishvili p 1–5 (See N66-39327 24-15)

2. PROPERTIES OF IRON PURIFIED BY ELECTRON-BEAM ZONE MELTING V. I. Shiryayev and V. D. Pautov p 6–10 refs (See N66-39328 24-17)

3. UNIT FOR NON-CRUCIBLE ZONE REFINING OF REFRACTORY METALS WITH AN ELECTRON-BEAM IN A VACUUM V. Ya. Shlyuko and V. D. Derkach p 11–13 refs (See N66-39329 24-15)

N66-39427# Joint Publications Research Service, Washington, D. C.
EFFECT OF ULTRASONIC VIBRATIONS ON THE STRUCTURE OF MOLYBDENUM SUBJECTED TO ELECTRON-BEAM MELTING
G. F. Zaboronk, V. B. Milova, M. D. Polyakova, and T. V. Simonishvili *In its* Soviet Electron-Beam Technol. 21 Sep. 1966 p 1–5 Transl. into ENGLISH from Tsvetn. Metal (Moscow), no. 7, Jul. 1966 p 83–85 (See N66-39426 24-15) CFSTI: $1.00

The effect of ultrasonic and mechanical vibrations on the crystallization of molybdenum ingots melted in electronic furnaces was investigated. Ultrasonic vibrations greatly reduced grain size in the transverse direction. As the height of the ingot increased away from the zone of maximum vibration amplitude, the grains in the transverse cross section became larger. The effect of ultrasonic vibrations did not produce a noticeable grain refinement in the longitudinal direction. Molybdenum melted using ultrasonic vibrations had a Brinell hardness of 153 to 156 kg/mm^2. Ingots obtained by conventional electronic melting and ingots obtained by ultrasonic vibrations were hot forged, rolled into 1mm thick sheets, and tested for elongation in cold working and annealed states. No sharp difference in relative elongation were observed at annealing temperatures up to 1000°C; however, above this temperature, a sharp decline in the relative elongation of Mo obtained by conventional methods was observed, while the Mo melted using ultrasonic vibrations retained its comparatively high relative elongation. S.C.W.

N66-39429# Joint Publications Research Service, Washington, D. C.
UNIT FOR NON-CRUCIBLE ZONE REFINING OF REFRACTORY METALS WITH AN ELECTRON-BEAM IN A VACUUM
V. Ya. Shlyuko and V. D. Derkach *In its* Soviet Electron-Beam Technol. 21 Sep. 1966 p 11–13 refs Transl. into ENGLISH from Zavodsk. Lab. (Moscow), no. 11, Nov. 1965 p 1408–1410 (See N66-39326 24-15) CFSTI: $1.00

Described is a non-crucible laboratory unit for zone refining refractory metals with the aid of an electron beam in a vacuum. The heating of the material for zone refining is accomplished by three electron guns connected through a high voltage transformer to a network of alternating current. The unit consists of a vacuum chamber with three electron guns, a vacuum system, an electric supply block for the electron guns, a control panel, and a mechanism for shifting the test specimen. The unit was used for refining molybdenum wire 6 mm in diameter and 180 mm long which was obtained after a rotary forging. The Mo wire was refined at a rate of 1 cm/hour. After nine passes through the zone, the Mo rod was easily worked by cold forging. No typical stratification was observed when the wire was subjected to flexible breaking. S.C.W.

N66-39571# Mechanical Technology, Inc., Latham, N. Y.
EXPLORATORY INVESTIGATION OF EXTERNALLY-PRESSURIZED STEAM-LUBRICATED JOURNAL BEARING INSTABILITIES
Denis E. Dougherty and F. K. Orcutt Aug. 1966 24 p refs
(Contract Nonr-3731(00) FBM)
(MTI-66TR37; AD-637276) CFSTI: HC $1.00/MF $0.50

This report describes the results of an exploratory investigation aimed at providing further insight into the nature of the instabilities and into ways of avoiding them with less restriction on steam supply and environmental conditions. The results are encouraging since they show that it is possible to start steam bearings from room temperature and operate with no external heating without serious instability. TAB

N66-39590# ARO, Inc., Arnold Air Force Station, Tenn.
VACUUM PUMPING PERFORMANCE COMPARISON AND SOME RELATED AEROSPACE APPLICATIONS

Andrew Lennert and R. L. Wilson. Arnold Eng. Develop. Center, May 1966. 16 p.
(Contract AF 40(600)-1200)
(AEDC-TW-66-6; AD-637578) CFSTI: HC $1.00/MF $0.50

This report consists of a brief comparison of oil diffusion pumps manufactured by Germany, Japan, and the USA, and a presentation of the general applications of various vacuum pumps. Author (TAB)

N66-39593# General Electric Co., Cincinnati, Ohio. Materials Development Lab. Operation.
THE PRODUCTION, TESTING AND EVALUATION OF AUSFORMED BALL BEARINGS Final Engineering Report, Jan. 1965–Jun. 1966
E. N. Bamberger. 15 Jun. 1966. 106 p. refs.
(Contract NOw-65-0070-f)
(AD-637576) CFSTI: HC $4.00/MF $0.75

A development program was conducted to establish the feasibility of ausforming full scale bearing components, and by life testing, to establish the effects of ausforming on bearing life and reliability. Ausformed 207 size (35 mm bore) ball bearing inner rings and balls (7/16 in. D) have been produced by extruding CVM-M-50 while in the metastable austenitic condition. Metallurgical examination showed these parts to possess the desired ausformed structure. X-ray examination showed the parts to be structurally sound. The results of these tests showed that the ausformed bearings had B sub 10 lives 9 times greater than standard heat treated CVM-M-50 bearings. This confirms work performed previously where rig testing had shown ausformed material to have a B sub 10 life 6.5 times in excess of standard material. Recommendations are made relative to the phasing in of ausformed bearings into critical applications. (Author) TAB

N66-39601# IIT Research Inst., Chicago, Ill. Technology Center.
DEVELOPMENT OF A PROCESS FOR PNEUMATIC EXTRUSION OF METALS First Quarterly Report
L. A. Finlayson. Watertown, Mass., Army Mater. Res. Agency, Apr. 1966. 25 p. ref.
(Contract DA-19-066-AMC-307(X))
(AMRA-CR-66-04/1; AD-637551) CFSTI: HC $1.00/MF $0.50

The report contains the results obtained extruding metals using both fluid and gas pressure medium on a small scale unit. Also included are the designs of the large scale unit now being constructed. A technical discussion is presented on the sealing required between die and billet and also the ram seal. (Author) TAB

N66-39614*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CAVITATION PERFORMANCE OF AN 83° HELICAL INDUCER OPERATED IN LIQUID HYDROGEN
George W. Lewis, Jr., Edward R. Tysl, and Donald M. Sandercock. Washington, NASA, Mar. 1961. 29 p. refs.
(NASA-TM-X-419) CFSTI: HC $2.00/MF $0.50 CSCL 13K
(Declassified)

A flat-plate helical inducer (1.88-in. diam.) having two constant-thickness blades and a constant 0.4 hubtip radius ratio was tested in liquid hydrogen. Noncavitating and cavitating performance in liquid hydrogen are presented. Performance comparisons with similar inducers operated in water are also presented. Author

N66-39628# Naval Air Engineering Center, Philadelphia, Pa. Aeronautical Materials Lab.
DEVELOPMENT OF A FUEL SIGHT WINDOW FOR EXTERNAL FUEL TANKS AND PREPARATION OF ENGINEERING DOCUMENTATION FOR SAME
Franklin T. Perry. 8 Jul. 1966. 13 p. ref.
(NAEC-AML-2473; AD-637255) CFSTI: HC $1.00/MF $0.50

Three types of full fuel indicators are described. Indicators considered include a prism focused fuel window, a positive float indicator with permanently mounted float housing, and a positive float indicator with a totally removable housing. It is concluded that the prism focused fuel window provides an efficient method of determining the full fuel condition, and that the substitution of a cylindrical plexiglass tube for the present design provides a more stable and durable condition as demonstrated by test results. A.G.O.

N66-39716*# Ryan Aeronautical Co., San Diego, Calif.
REPORT ON EXPLOSIVE SIZING OF 70-INCH DIAMETER WELDED ALUMINUM PREFORMS FROM 5086, 2014 T4 AND 2014 T6 MATERIAL Final Report, 5 Dec. 1961–30 Mar. 1962
E. M. Magdich. 16 Apr. 1962. 28 p. *Its* Rept.-628057
(Contract NAS8-2528)
(NASA-CR-78862) CFSTI: HC $2.00/MF $0.50 CSCL 13H

Details are given on the explosive sizing of 70-in. diameter bulkheads fabricated from welded preforms and on the tool design of an explosive form die for the explosive forming of gore sections for a 396-in. diam. head. Results indicated the following: the welding tooling for both the longitudinal and circumferential welds must be the best possible; the success in rolling of the circumferential mating edges depends on the thickness of the material to be rolled; correct edge preparation prior to all rolling is mandatory; and rolling of individual cones has to be accurately controlled to eliminate stress buildup in the longitudinal weld joint. It was concluded that bulkheads made of .160- and .250-in. thick aluminum material may be successfully explosively sized under the following conditions: correct development of cone flat pattern; controlled rolling and trimming of cones; correct edge preparation; cleanliness of material; controlled rolling of all circumferential mating edges; and good welding machine and welding techniques. L.E.W.

N66-39720*# Battelle Memorial Inst., Columbus, Ohio.
RELAXATION DESIGN OF SEPARABLE TUBE CONNECTORS
L. M. Cassidy, E. C. Rodabaugh, D. B. Roach, and T. M. Trainer. 22 Jul. 1964. 85 p. refs. Prepared for Gen. Elec.
(Contract NAS8-11523)
(NASA-CR-78959) CFSTI: HC $3.00/MF $0.75 CSCL 13E

A design procedure is developed for predicting the relaxation or time to leakage for separable tube connectors, including bolted–flanged and threaded types. The procedure is based upon the steady-state creep law, revised to account for the effects of primary creep. Sample calculations provided for René 41 at 1500°F. The analysis includes the effects of external loads and temperature differentials. René 41 is selected as the best material currently available for use at 1440°F. Author

N66-39764# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF TECHNOLOGICAL LUBRICANTS BASED ON SALT MIXTURES FOR HOT ROLLING OF TUBES
G. A. Rodionova and Ya. S. Finkel'shteyn. 22 Apr. 1966. 24 p. refs. Transl. into ENGLISH from the publ. "Fiziko-Khimicheskie Zakonomernosti Deistviya Smazok pri Obrabotke Metallov Daveniem" USSR, 1963. p. 124–135.
(FTD-MT-65-118; TT-66-62069; AD-637373) CFSTI: HC $1.00/MF $0.50

The fundamental possibility of the application of salt lubricants for continuous hot rolling of tubes was confirmed. The best properties are possessed by a lubricant with the following composition: 40% zinc chloride, 30% potassium chloride, 30% sodium chloride, 10% (of the weight of the salts) magnesium oxide and 45% (of the salts and filler) water. The pickling time for tubes rolled with a salt lubricant decreases twice as compared to that of

tubes rolled with graphite-mazut lubricant. It was found that a salt lubricant remaining on the internal surface of tubes promotes general corrosion of the metal of the tubes. The influence of the quantity of the various fillers and components of the lubricant on the melting and crystallization temperatures, and also the influence of the quantity of diluent on the consistency of the lubricant (determining the covering ability per unit of surface of the mandrel), were established. TAB

N66-39853# Boeing Co., Morton, Pa. Vertol Div.
DESIGN AND TEST EVALUATION OF A SUPERCRITICAL SPEED SHAFT Final Report
Robert Baier and John Mack Jun. 1966 188 p refs
(Contract DA-44-177-AMC-16(T))
(R-458; USAAULABS-TR-66-49; AD-637214) CFSTI: HC $5.00/MF $1.00

The report describes the research, evaluation, experimental procedures, and conclusions from a study of the feasibility of the use of a supercritical speed interconnecting shaft in helicopters and other aircraft that require interconnecting drive shafts. The program was centered around the design, construction, and test of a full-scale supercritical speed shaft with dimensions compatible with the Boeing-Vertol CH-47A helicopter. Particular emphasis was placed on the design and development of suitable dampers for supercritical speed shaft installations, and on the development of shaft balancing procedures suitable for production application. The test shaft was operated successfully through a speed range from 0 to 9500 revolutions per minute, and subsequent analysis showed that the supercritical speed shaft offers a number of advantages over the subcritical speed shafts that are now used. All methods, procedures, and results are thoroughly documented with substantiating data, and firm conclusions and recommendations are presented. Four mathematical appendixes are provided Author (TAB)

N66-39975*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL AND THEORETICAL STUDY OF THE VISCOSEAL
John Zuk, L. P. Ludwig, and R. L. Johnson Washington, NASA, 1966 84 p refs Presented at the Meeting on Develop. of Turbulent-flow Bearings and Seals for Process-fluid Lubricated Turbomachinery, Latham, N. Y., 1 Nov. 1966
(NASA-TM-X-52245) CFSTI: HC $2.50/MF $0.75 CSCL 11A

Investigated were pressure patterns, gas ingestion, and sealing capacity of viscoseals. Oil, water, and liquid sodium were used as the sealed fluids. Experimental arrangements and results are discussed. A set of two-dimensional equations was formulated for a quasi-two-dimensional flow field in parallel groove geometries which can be used as a mathematical model for the viscoseal. The model consisted of an infinite smooth plate moving relative to a fixed infinite parallel groove–ridge surface with the clearance filled with an incompressible, homogeneous Newtonian fluid. A modified Reynolds number evolved that is based on a groove–ridge characteristic length parallel to the smooth plate velocity vector. Application of the modified Reynolds number to published experimental results reveals that a significant improvement in bearing number or sealing coefficient occurred when the modified Reynolds number was near unity. This analysis provides a unified approach which was previously covered by the creeping flow and the semiempirical turbulent flow analyses; it applies equally to hydrodynamic seals, bearings, and pumps. K.W.

N66-39976*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTS WITH HYDRODYNAMIC JOURNAL BEARINGS OF VARIOUS MATERIALS AND DESIGNS IN SODIUM AT TEMPERATURES TO 800°F
Frederick T. Schuller, William J. Anderson, Zolton Nemeth Washington, NASA, 1966 35 p refs Presented at the Meeting on Develop. of Turbulent-flow Bearings and Seals for Process-fluid Lubricated Turbomachinery, Latham, N. Y., 1 Nov. 1966
(NASA-TM-X-52247) CFSTI: HC $2.00/MF $0.50 CSCL 13I

Experiments were conducted with 1.5 inch diameter hydrodynamic journal bearings in liquid sodium at 500° and 800°F, speeds to 12,000 rpm and unit loads to 31 psi. The stability characteristics of four different geometries and the wear and seizure properties of several material combinations were investigated. Tilting pad bearings were most stable. Combinations of a cobalt alloy with alloys or with a titanium carbide cermet showed the best wear and seizure properties. Author

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N66-39324# Royal Netherlands Navy, The Hague.
COMMENTS TO SECTION V PAGE 5 OF PAPER NO. SYM/P/2 BY MR. V. F. URBAN, B. S. c., PRESENTED AT THE TELLUROMETER SYMPOSIUM LONDON, AUGUST, 1962
J. Th. Verstelle *In* Tellurometer (Pty.), Ltd. Proc. of the 1962 Tellurometer Symp. [1962] 7 p (See N66-39306 24-14)
CFSTI: HC $6.00/MF $1.75

The feasibility of using maser beams for an active system of automatic camera levelling in an aircraft is considered. The advantages of masers are summarized, and various aspects of the suggested application are discussed, including general, ultimate accuracy, servo system, and radio frequency requirements. Technical requirements and limitations and operational limitations are delineated, and it is concluded that the idea of using masers, and lasers, for active camera axis verticality control cannot be realized. L.E.W.

N66-39411# Joint Publications Research Service, Washington, D. C.
HEATING OF A BILAYER SHEET IN WELDING WITH A LASER BEAM
N. W. Rykalin, A. A. Uglov, and N. I. Makarov 27 Sep. 1966 12 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 19, no. 3, 1966 p 565–568
(JPRS-37856; TT-66-34284) CFSTI: $1.00

The temperature distribution in a bilayer sheet subjected to a heat source located on its surface is considered as one of the problem areas in the application of lasers for use in welding. The equations which describe this problem are provided, and solutions for these equations are given. H.S.W.

N66-39423# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROGRESS OF PHYSICAL SCIENCES Selected Articles
28 Feb. 1966 58 p refs Transl. into ENGLISH from Usp. Fiz. Nauk (Moscow), v. 83, no. 2, 1964 p 197–222; 361–369
(FTD-MT-65-49; TT-66-62045; AD-637098) CFSTI: HC $2.00/MF $0.50

CONTENTS:

1. STIMULATED COMBINATION SCATTERING OF LIGHT V. A. Zubov, M. M. Sushchinskiy, and I. K. Shuvalov p 1–30 refs (See N66-39424 24-16)

2. THE TENTH ALL-UNION CONFERENCE ON LOW TEMPERATURE PHYSICS p 33–45

N66-39424# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STIMULATED COMBINATION SCATTERING OF LIGHT
V. A. Zubov, M. M. Sushchinskiy, and I. K. Shuvalov *In its* Progr. in Phys. Sci. 28 Feb. 1966 p 1-30 refs (See N66-39423 24-16) CFSTI: HC $2.00/MF $0.50

The characteristic traits of usual combination light scattering in the Stokes region and the radiation of quantum generators are discussed with respect to the phenomenon of stimulated, or forced, combination light scattering. Experimental results are presented for stimulated combination scattering in nitrobenzene inside the cavity of a resonator and for organic liquids outside the cavity. Investigations of the spectral composition of emitted radiation of organic liquids demonstrated the following conclusions: spectra are extraordinarily intense, and a single pulse from the pumping generator is fully sufficient for production of a spectrogram. Spectra contain both Stokes and anti-Stokes lines of almost identical intensity, where every spectrum contains not only the line of fundamental frequency but also lines with frequencies that are exact multiples of this frequency. Studies of spectra of liquified gases showed this character to be similar to that of organic liquids. The semiclassical and quantum theories of combination scattering are discussed, and analyses of the time characteristic of build-up intensity of forced combination scattering and decrease of width of the radiated combination line are presented. S.P.

N66-39446*# North American Aviation, Inc., Downey, Calif. Space and Information Systems Div.
REQUIREMENTS STUDY FOR SYSTEM IMPLEMENTATION OF AN ATMOSPHERIC LASER PROPAGATION EXPERIMENT PROGRAM, VOLUME II
H. E. Henry, R. N. Hathaway, J. O. Garvey, E. J. Stegelmann, D. G. Lubnau et al 8 Nov. 1965 301 p refs
(Contract NASw-977)
(NASA-CR-78855; SID-65-1466) CFSTI: HC $7.00/MF $1.75 CSCL 20E

The system implementation study of the laser space communications system is reported. A description and component performance analysis is given for each experiment, including experiment configuration and the required equipment list. A system synthesis is presented, with experiments grouped into a basic application-oriented program, a minimum theory-oriented program, and the maximum program. Site support considerations are discussed, including the selection of suitable sites, and information on available weather facilities and statistical weather data. Discussions are presented on ground, airborne, balloon, and satellite links. It was concluded that: (1) System components and well-instrumented accessible sites for stationary ground-based links are available. (2) Aircraft and balloon platforms with required support are also available. (3) A thorough field testing with ground-based and airborne platforms is necessary. N.E.N.

N66-39447*# North American Aviation, Inc., Downey, Calif. Space and Information Systems Div.
PROGRAM SPECIFICATION PLAN FOR THE DETERMINATION OF ATMOSPHERIC EFFECTS ON LASER SPACE COMMUNICATIONS, VOLUME II
R. N. Hathaway, D. L. Fried, and H. E. Henry 9 Nov. 1965 78 p
(Contract NASw-977)
(NASA-CR-78856; SID-65-1467) CFSTI: HC $3.00/MF $0.75 CSCL 20E

The program specification of the laser space communications system study is summarized. The approach to a program of field experimentation to determine atmospheric effects on laser propagation is outlined. The theoretical versus experimental aspects were considered, emphasizing space and non-space tests, and performance characteristics of experimental equipment. Anticipated problem areas are identified as (1) the unknown reliability of laboratory equipment in a field environment and (2) the utilization of small specialized test teams with a wide geographic spread. The program sequence recommendations, schedule, and implementation cost estimates are included. N.E.N.

N66-39448*# North American Aviation, Inc., Downey, Calif. Space and Information Systems Div.
LASER SPACE COMMUNICATIONS STUDY (LACE) Final Summary Report
12 Nov. 1965 64 p refs
(Contract NASw-977)
(NASA-CR-78854; SID-65-1468) CFSTI: HC $3.00/MF $0.75 CSCL 20E

The results, conclusions, and recommendations of the study for the implementation of an experimental program to determine the atmospheric effects on laser space–ground communication are summarized. The problem definition, experiment specification, and system implementation study are outlined. N.E.N.

N66-39473# Aerospace Medical Div. Aerospace Medical Research Labs.
A STUDY OF LIGHT MODULATION AND SCANNING TECHNIQUES FOR APPLICATION TO SIMULATION DISPLAY GENERATION Final Report, Jun. 1964–Jun. 1965
W. L. Foley Mar. 1966 58 p refs
(AMRL-TR-66-9; AD-637307) CFSTI: HC $3.00/MF $0.50

Various techniques for modulation and scanning of coherent light are analyzed for application to the generation of high resolution high contrast displays for simulation. A number of possible techniques are discussed in the main body of the report. The individual discussions include a brief description of the principles of operation together with capabilities relative to bandwidth, contrast ratio, deflection angle, alignment, sensitivity, ease of fabrication, and handling. This is based somewhat upon voltage and power requirements over range of operation.
Author (TAB)

N66-39487# Stanford Univ., Calif. Microwave Lab.
THE MEASUREMENT OF SEVERAL OPTICAL NONLINEARITIES USING FOCUSED GAUSSIAN LASER BEAMS
John E. Bjorkholm Jan. 1966 133 p refs
(Contract AF 49(638)-1525)
(ML-1405; AFOSR-66-0490; AD-637500) CFSTI: HC $4.00/MF $1.00

The twofold purpose of this study was: (1) to analyze optical second-harmonic generation (SHG) in the focus of the lowest order transverse mode of a cw gas laser beam; (2) to utilize the power enhancement available from focusing to measure smaller nonlinearities on a cw basis than previously had been done. The results of the analysis give the dependence of SHG in index-matching crystals upon the crystal length, the crystal double-refraction angle, and the laser beam focal spot size w_0. The dependence of SHG upon w_0 was measured using varying degrees of focusing. The absolute power levels were checked by measuring the absolute value of the nonlinearity in ADP. The excellent agreement between analysis and experiment means that focused beams can be used to make accurate measurements of crystal nonlinearities. The second section of this study describes measurements of several optical nonlinearities in calcite made under conditions of optimum focusing using cw gas lasers. Since calcite has a center of inversion, the nonlinearities measured are of higher order than normal dipolar SHG; the resulting effects are much weaker, requiring the use of focused beams to detect them. Measurements were made of quadrupole-type SHG, electric-field-induced SHG, and the quadratic electro-optic effect. Author (TAB)

N66-39733# Air Force Cambridge Research Labs., Bedford, Mass. Microwave Physics Lab.
THE SAGNAC EFFECT

E. J. Post May 1966 51 p refs *Its* Phys. Sci. Res. Papers No. 224
(AFCRL-66-311; AD-637717) CFSTI: HC $3.00/MF $0.50

A revived interest in the Sagnac effect, because of its navigational potentialities has recently resulted from the development of the self-oscillating laser version of the original Sagnac interferometer. Where the Sagnac interferometer or ring laser is an example of an electromagnetic sensor of absolute rotation, it was believed that some historical and theoretical background information might be useful in exploring and further evaluating the possibilities of electromagnetic sensing of absolute rotation. A critical literature study of the many experimental ramifications and the older kinematical theory of the effect is presented. This geometric optical theory is then complemented and compared with more recent work that is based on a physical optical analysis using a complete electromagnetic description of the phenomenon Author (TAB)

N66-39741# Mithras, Inc., Cambridge, Mass.
LIGAND FIELD MILLIMETER MASER Final Report, Feb. 15, 1964–Feb. 14, 1966
Charles S. Naiman, Jack Schwartz, and Arthur Linz Apr. 1966 38 p refs
(Contract AF 19(628)-4006)
(MC-64-102-R2; AFCRL-66-357; AD-637683) CFSTI: HC $2.00/MF $0.50

A report is given of work dealing with theoretical and experimental investigation of the properties of ferroelectric materials leading to the development of materials with the special properties necessary for the operation of a Ligant Field Maser in the millimeter range. Measurement of ligand fields near ground state crossovers by optical and microwave spectroscopy are discussed as well as magnetometer methods. Means by which Ligand Field Variation may be accomplished are considered, with associated experimental techniques. Experience in the preparation of suitable materials and growth of single crystals are presented, and various possibilities analyzed. (Author) TAB

N66-39795# Pennsylvania State Univ., University Park. Dept. of Physics.
STIMULATED EFFECTS IN N_2 AND CH_4 GASES
T. A. Wiggins, R. V. Wick, and D. H. Rank [1966] 17 p refs
(Contract Nonr-656(12))
(AD-638674) CFSTI: HC $1.00/MF $0.50

Stimulated Brillouin scattering from N2 and CH4 using a giant pulse laser was observed in an arrangement where-by the laser cannot re-lase and amplify the backscattered radiation. This allows a quantitative study of the parameters affecting stimulated Brillouin scattering. The back-scattered beam converges at the same angle at which the laser beam diverges. The Brillouin component can have a narrow spectral width, 1/3 that of the laser itself, and in some cases can have a duration of only a few nanoseconds. N2 at high pressure can back-scatter as much as 45% of the incident power. The speeds of sound in CH4 and N2 were measured at lower pressures than were previously reported Author (TAB)

N66-39911*# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.
RADIATION EFFECTS ON LASERS Technical Report, Jul. 1, 1965–May 31, 1966
D. M. J. Compton and R. A. Cesena 21 Sep. 1966 77 p refs
(Contract NAS12-32)
(NASA-CR-79108; GA-7274) CFSTI: HC $3.00/MF $0.75 CSCL 20E

In a study on the effects of space radiation on lasers, a discussion is given of the mechanisms by which these effects can occur, and of a suitable choice of parameters to be measured. These include active tests; measurements of coherence and of near and far field patterns; passive tests; optical transmission measurements; and scattering of transmitted gas laser light. Methods of measuring these parameters were developed and applied to optically pumped lasers such as ruby, $CaWO_4$:Nd, YAG:Nd and Glass: Nd, and GaAs diode injection lasers, before and after irradiation with 32 Mev protons, 30 Mev electrons, and reactor γ rays. For GaAs diodes, irradiation does not change the current voltage curve, but degrades the optical output and changes the output wavelength spectrum. Coherence and far-field patterns are changed for all lasers if the input power is increased after irradiation to keep output power constant, and heating seems to be a more important cause of these changes than any direct effects of irradiation. Author

N66-39966*# Melpar, Inc., Falls Church, Va. Electronics Research Lab.
A STUDY OF LASER WAVE SCATTERING DUE TO REFRACTIVE INDEX PERTURBATIONS IN THE PROPAGATING MEDIUM Final Report, 5 Oct. 1965–15 Aug. 1966
S. B. Sample and S. J. Campanella Aug. 1966 97 p refs
(Contract NAS9-5315)
(NASA-CR-65553) CFSTI: HC $2.50/MF $0.75 CSCL 20F

The purpose of this contract was to expand the GT-7 laser communicator experiment into a scientific study of laser wave scattering due to refractive index perturbations in the atmosphere. This report contains a complete description of the two data recording and processing systems that were constructed on the contract. It also describes the activities of the personnel who were stationed at the White Sands and Ascension Island Laser Communicator Sites during the flight of GT-7. An analysis of the data obtained during static laser wave propagation experiments at the WSMR site is included. Finally, the report presents recommendations for future space-to-earth and ground-based laser wave propagation experiments that seem necessary in order to further clarify the nature of optical propagation over great distances in the atmosphere. Author

N66-39992*# North American Aviation, Inc., Downey, Calif. Space and Information Systems Div.
SPECIFICATION OF ATMOSPHERIC LASER PROPAGATION EXPERIMENTS, VOLUME II
15 Sep. 1965 refs
(Contract NASw-977)
(NASA-CR-79094; SID-65-1275) CFSTI: HC $5.00/MF $1.00 CSCL 20E

Specifications are presented for a comprehensive experimental program to determine atmospheric effects on laser propagation, with particular emphasis on effects related to optical space–ground communication. The interrelationships between the optical effect, experimental variables, and individual variables are examined in a discussion on measurement approach. Also included are some basic interpretations of beam fluctuations in a turbulent atmosphere, a glossary of related terms and proposed modifications in the approach to the meterological experiments. Experimental procedures are outlined, and error and measurement analyses are prescribed. Error sources described are the result of considerations such as beam splitters, piezoelectric crystals, entrance aperture, signal to noise and gain, background, measurement time and number of measurements, mechanical vibration, tracking, circuitry maladjustments, modulators, and spot size. S.P.

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N66-38998# Joint Publications Research Service, Washington, D. C.

METALS OF THE COSMIC AGE

D. Rozen 12 Oct. 1966 13 p Transl. into ENGLISH from Nauka i Tekhn. (Riga), no. 7, 1966 p 13–15 (JPRS-38123; TT-66-34550) CFSTI: $1.00

A general, comprehensive report is presented on present and future uses of the rare-earth metals. Examples are given of the quantitative distribution in the earth's crust. Some of the unique properties of these metals are pointed out, and their role in the manufacture of alloys, semiconductor devices, photo elements, solar batteries, and reactor fuels are discussed. The potential of the rare-earth metals for causing radical changes in science and technology is stressed. K.W.

N66-39006# Joint Publications Research Service, Washington, D. C.

ALUMINUM ALLOY RESEARCH IN THE USSR

I. N. Fridlyander, ed. 27 Sep. 1966 443 p refs Transl. into ENGLISH of the Book "Alyuminiyevyye Splavy, Vypusk 4, Zharoprochnyye i Vysokoprochnyye Moscow, 1966 p 3–352 (JPRS-37845; TT-66-34273) CFSTI: $7.00

Articles on production, use, and properties of heat resistant and high strength aluminum alloys are presented. For individual titles see N66-39007–N66-39050.

N66-39007# Joint Publications Research Service, Washington, D. C.

PROPERTIES OF VAD-23 ALLOY

I. N. Fridlyander, O. A. Romanova, and A. N. Archakova *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 3–16 refs (See N66-39006 24-17) CFSTI: $7.30

Characteristics are studied for a high strength, heat resistant deformable aluminum alloy (VAD-23) derived from the Al–Cu–Li–Cd–Mn system; and changes in mechanical properties of such alloys with varying amounts of Cu, Li, Cd, Mn, Ti, Fe, and Si were investigated. Increase in strength due to addition of lithium was attributed to the effect of artificial aging, and to lesser extent to tempering. In annealed and freshly tempered alloys, lower strengths were displayed. Increase in copper content from 4 to 5%, with a lithium content of 1.3%, increases alloy strength, yield point at high temperatures, and time required to destroy the specimens; whereas elongation capability is decreased by the copper addition, especially in the artificially aged state. Manganese usually leads to simultaneous increase of strength and plasticity. Small additions of cadmium increase significantly the yield point, but lowering of elongation capability is evidenced. Titanium additions of 0.15% increase alloy durability, but no significant effect is noted when the increase is as high as 0.3%. Results are reported for aging effects of the aluminum alloy. M.W.R.

N66-39008# Joint Publications Research Service, Washington, D. C.

HOT BRITTLENESS STATE OF ALLOYS OF THE AL–CU–LI–MN SYSTEM

O. Ye. Grushko, I. I. Novikov, and A. Ye. Semenov *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 17–24 refs (See N66-39006 24-17) CFSTI: $7.30

Effects of metal composition on the hot brittleness state of other properties are considered for ring specimens of alloys which contain varying amounts of Al, Cd, Cu, Li, and/or Mn. Relative elongation and linear shrinkage in the solid-fluid state were investigated; and for most of the alloys, it was found that an increase in lithium and copper content elongation increased, but hot brittleness of an industrial alloy (VAD-23) decreased. It was concluded that copper and lithium content should be maintained close to the upper limits of technical specifications, and cadmium and manganese close to their lower limits of crystallization cracks are to be held to a minimum. M.W.R.

N66-39009# Joint Publications Research Service, Washington, D. C.

SOME CHARACTERISTIC FEATURES OF THE PRODUCTION OF VAD-23 ALLOY

I. Ya. Zal'taman, O. Ye. Grushko, A. Ye. Semenov, V. A. Zasypkin, N. D. Vinokurov et al *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 25–31 refs (See N66-39006 24-17) CFSTI: $7.30

Production of an industrial alloy of aluminum (VAD-23) must be conducted under a layer of flux, which contains a eutectic mixture of lithium chloride and potassium chloride. This appears to protect the alloy, which is derived from an Al–Cd–Cu–Li–Mn system, from lithium burn-out. Refining the melt with gaseous chlorine following the addition of lithium results in the required purity of the metal ingots in terms of slag and oxide content. M.W.R.

N66-39010# Joint Publications Research Service, Washington, D. C.

TECHNOLOGY OF CASTING OF VAD-23 INGOTS. DEVELOPMENT OF CONDITIONS FOR INGOT CASTING

O. Ye. Grushko, I. Ya. Zal'taman, N. D. Vinokurov, A. Ye. Semenov, V. A. Zasypkin et al *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 32–39 refs (See N66-39006 24-17) CFSTI: $7.30

Casting properties, thermal conditions required for ingot casting, and protection methods were investigated for an industrial alloy (VAD-23). Effects of temperature, casting rate, and intensity of cooling on the quality of ingots produced are reported. The most efficient temperature range is found to be 700° to 730°C; casting at lower temperatures leads to deep folds and plugging. Optimum casting rates of 37 to 53 mm/min are reported for ingots of 280 mm in diameter; and 28 to 35 mm/min for ingots of 380 mm in diameter. Mechanical properties and microstructure are investigated for the industrial alloy which is derived from the Al–Cd–Cu–Li–Mn system. The micropores that sometimes appear in the peripheral zone of the ingots are attributed to segregation of liquid enriched in copper. Properties of ingots of 280 and 380 mm in diameter are approximately the same because of sufficiently low casting rates, shallow streaming, and the nature of crystallization; and smaller diameter ingots are reported to have greater tensile strength and greater relative elongation. M.W.R.

N66-39011# Joint Publications Research Service, Washington, D. C.

EFFECT OF COARSE AND FINE STRUCTURE ON HEAT-RESISTANCE OF THE DEFORMED ALUMINUM ALLOY D-20

O. A. Romanova *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 40–45 refs (See N66-39006 24-17) CFSTI: $7.30

Coarse grain structure of pressed strips of a deformable aluminum alloy (D-20) exhibits higher thermal stability at 300° to 350°C than do fine grain strips. The alloy contains 6.2% copper and less than 1% each of iron, magnesium, manganese, silicon, and titanium. Durability of the alloy increases with aging temperature; and in the optimum aging temperature range of 204° to 220°C, there is a significant difference in favor of the coarse grain structure. M.W.R.

N66-39012# Joint Publications Research Service, Washington, D. C.

PRODUCTION OF PRESSED SEMIFINISHED PRODUCTS FROM VAD-23 ALLOY

K. N. Mikaylov, V. G. Kovrizhnykh, Z. N. Archakova, V. M. Baranchikov, V. S. Sandler et al *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 46–60 (See N66-39006 24-17) CFSTI: $7.30

Effect of diffusion annealing and the form of the final blank on the mechanical properties of the aluminum alloy VAD-23 are reported. Optimum mechanical properties are obtained when pressing is conducted directly on the ingot which has first been subjected to diffusion annealing. High strength and fairly good plasticity are obtained along the length of pressing profiles greater than 5 mm in the temperature range of 470° to 490°C. The magnitude of relative elongation of profiles is almost independent of pressing temperature and degree of recrystallization. Changes in pressing rates between 0.5 and 5.0 mm/min at temperatures between 250° and 430°C do not affect the plasticity of VAD-23, and increase strength characteristics slightly. To retard the recrystallization process in samples pressed at 470° to 490°C which are heated before tempering, the stretching coefficient must be no greater than 25 or 30. M.W.R.

N66-39013# Joint Publications Research Service, Washington, D. C.

INVESTIGATION OF PRESSED PROFILES AND PANELS FROM D-20 ALLOY

O. A. Romanov, Z. N. Archakova, and N. I. Vasil'yeva *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 61–70 (See N66-39006 24-17) CFSTI: $7.30

Structure and mechanical properties are investigated for pressed articles made from a deformable and weldable heat resistant alloy (D-20), which is derived from the Al–Cu–Mn system. Optimum mechanical properties were obtained by tempering after heating at 535°±5°C, and artificial aging at 160° to 170°C for 16 hours. Stretching between 14 and 43.4 mm, pressing temperatures between 320° and 480°C, and diffusion annealing produce no significant effect on the structure and mechanical properties of 2- and 5-mm shapes. The yield point is significantly increased if the profiles are stretched after tempering, even though tensile strength and relative elongation remain almost unchanged. Relatively fine grain and uniform structures are observed following pressing under the different conditions. Strength of panels is somewhat higher than that of thin-walled shapes, but relative elongation is lower for the latter. M.W.R.

N66-39014# Joint Publications Research Service, Washington, D. C.

EFFECT OF HEATING PRIOR TO TEMPERING AND DEGREE OF COLD-WORKING AFTER TEMPERING ON THE MECHANICAL PROPERTIES AND STRUCTURE OF PRESSED SHAPES FROM VAD-23

Z. N. Archakova, V. G. Kovrizhnyk, V. S. Sandler, V. A. Shvets, and N. S. Lebedeva *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 71–80 (See N66-39006 24-17) CFSTI: $7.30

Prior to tempering, the temperature of pressed semifinished products of the aluminum alloy VAD-23 must be maintained at between 515° and 525°C; and the stretching coefficient during pressing must be between 15 and 25 for shapes with wall thicknesses up to 10 mm. It is found that repeated tempering changes the strength characteristics of pressed profiles from +1.7 to −11.6 kg-force/mm^2 and the relative elongation from +0.9 to −4.5%. This negative effect from repeated tempering increases with the increase of (1) stretching coefficient during pressing and (2) cold deformation after the initial and second temperings. M.W.R.

N66-39015# Joint Publications Research Service, Washington, D. C.

TECHNOLOGY OF PRODUCTION AND MECHANICAL PROPERTIES OF SHEETS FROM VAD-23 ALLOY

K. N. Mikaylov, M. B. Ovodenko, Z. N. Archakova, Ye. F. Chernoskutov, and V. A. Shvets *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 81–86 refs (See N66-39006 24-17) CFSTI: $7.30

Clad sheets of VAD-23 alloy were produced under industrial conditions from round ingots cast by the immersion methods, with an optimum temperature of about 280°C. The optimum chemical content is found to be no more than 5.3% copper and 1.3% lithium. An increase in lithium content to 1.4% increases alloy strength, but lowers plasticity. A cladding process is described by which sheets of between 0.5 and 5.0 mm in thickness can be produced. The production of unclad sheets from VAD-23 is considered feasible. M.W.R.

N66-39016# Joint Publications Research Service, Washington, D. C.

STUDY OF THE COOROSION STABILITY OF VAD-23 ALLOY

V. A. Klimova *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 87–96 refs (See N66-39006 24-17) CFSTI: $7.30

Temperature of quenching water, additional heating, and cold hardening effects on corrosion are compared for two alloys of the Al–Cu–Li–Cd–Mn system, VAD-23 and D-16, which were tempered and aged at 170°C for 16 hr and at 190°C for 12 hr. In both alloys, increasing from 5 to 10 sec the time required for transfer from the heating medium to the tempering bath leads to corrosion and lowering of strength. Both local and intragranular corrosion are noted when VAD-23 is quenched at 20°C, but only local corrosion is evidenced at higher temperatures; and following artificial aging at 170°C, there is neither intragranular corrosion cracking under stress. Aluminum cladding does not produce complete electrochemical protection of BAD-23 in 3% NaCl solution, and in 1% solution there is no protection at all. Corrosion stability of unclad specimens of both BAD-23 and D-16 is about the same. M.W.R.

N66-39018# Joint Publications Research Service, Washington, D. C.

MECHANICAL PROPERTIES OF VAD-23 ALLOY

N. V. Anisimova, Z. A. Archakov, S. Ye. Belyayev, Yu. S. Danilov, S. I. Kishkina et al *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 106–134 refs (See N66-39006 24-17) CFSTI: $7.30

Several aluminum alloys, including VAD-23 and D-16, are tested in their artificially aged states for short-duration stretching, compression crumpling, and shearing behavior. Under prolonged treatment at 20 to 150°C, the creep characteristics of VAD-23 are 20 to 25% better than those of D-16. During compression at temperatures between 150° and 175°C, yield points and complex profiles for VAD-23 sheets are 10 to 20% higher than those obtained during stretching. The VAD-23 specimens are highly sensitive to notches and sharp cracks; and the sheets are more sensitive than the semifinished products of this alloy. An alloy designated V-95 exhibits better static durability and fatigue resistance than VAD-23. M.W.R.

N66-39019# Joint Publications Research Service, Washington, D. C.

THE EFFECT OF THE ADDITION OF CADMIUM ON ARTIFICIAL AGING OF CERTAIN ALUMINUM ALLOYS

O. A. Romanova *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 135–139 refs (See N66-39006 24-17) CFSTI: $7.30

Cadmium is found to retard artificial aging in alloys of the Al–Cu–Mn system, whereas it produces an accelerating effect on Al–Cu and Al–Cu–Li–Cd–Mn systems. For the latter, which is known as VAD-23, tensile strength maxima are located at lower temperatures when cadmium is added. Pressed rods with diameters of 10 mm were used in this investigation of mechanical properties and aging temperature effects. M.W.R.

N66-39020# Joint Publications Research Service, Washington, D.C.

SENSITIVITY OF ATSM, RTSMU, AMG6 ALLOYS AND THEIR WELDING JOINTS TO CONCENTRATIONS OF STRESSES AND CRACKS

S. I. Kishkina, T. K. Zilova, N. V. Kadabrova, B. A. Drozdovskiy, V. S. Bubenshchikov et al *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 140–150 refs (See N66-39006 24-17) CFSTI: $7.30

Welded joints of a high strength aluminum alloy, (ATsM) are found to be highly sensitive to twist and crack; and this sensitivity is usually higher than the base metal of the semifinished product. An alloy (ATsMU) with less Mg, Mn, and Zn content is less sensitive; and content is less sensitive; and sheets and pressed shapes of AMg6M alloy and their welded joints are not very sensitive. An AMg6N sheet cold worked to the extent of 20% is sensitive to twist and crack, although the welded joints from AMg6M sheets are as insensitive as their annealed sheets and welded joints. Because of this low sensivity, AMg6N can be used in large-size welded structures which require high tensile strength. Massive forgings and pressed profiles from ATsMU and AMg6 alloys are detailed. Chemical compositions of the alloys are not given. M.W.R.

N66-39021# Joint Publications Research Service, Washington, D. C.

SLOW DESTRUCTION OF WELDED JOINTS OF AL-ZN-MG ALLOYS

I. N. Fridlyander, Ye. A. Kuznetsova, N. A. Davydova, V. S. Bubenshichikov, and I. A. Nabatova *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 151–167 refs (See N66-39006 24-17) CFSTI: $7.30

Behavior of welded joints of two Al–Zn–Mg alloys is investigated under stress in both atmospheric and argon media. Total Zn–Mg content is 6.3% in the ATsM alloy and 5.8% in ATsMU; manganese content is 0.6% and 0.3%; copper content is 0.25% and 0.1%; and Zr is 0.17%, Fe 0.3%, and Si 0.25% in both alloys. Welded joints of ATsMU have a tendency to slow destruction under atmospheric conditions less than those of ATsM. In an argon atmosphere, crack formation was not detected in either alloy after 50 to 60 days; and when these argon-exposed specimens were transferred to air, they held under stress for more than three months. Crack formations are, therefore, attributed to corrosion due to moisture exposure. For both alloys, aging at 90°C for 100 hr is considered optimum, since both sufficiently high mechanical properties are produced and resistance of welded joints to slow destruction appears to be insured. The highest absolute strength (47 kg-force/mm^2) is attained by welding after preliminary aging at 90°C, and subsequent aging at 70°C. M.W.R.

N66-39022# Joint Publications Research Service, Washington, D. C.

INVESTIGATION OF CHEMICAL INHOMOGENEITY IN WELDED JOINTS OF ATSM AND ATSMU ALLOYS

I. N. Fridlyander, O. A. Setyukov, I. I. Titareko, T. V. Barasheva, N. F. Lashko et al *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 168–177 (See N66-39006 24-17) CFSTI: $7.30 $7.30

Chemical, spectral, andX-ray microprobe analyses were made of the chemical composition of alloys (designated as ATsM and ATsMU) joints welded with AMg4 and AMg6 welding rods. It is shown that chemical composition usually depends on the composition of the base material and welding rod, thickness of the welded sheets, and rate of weld feeding. Increase in rate of feeding and decrease in thickness of welded sheets results in an increase of Mg and a decrease of Zn in the welded seam. single-phase or three-phase welding conditions have no influence. The X-ray diffraction probe indicates the existence of an Al_6Mn phase in ATsM and ATsMU alloys when the Mn concentration exceeds 0.26%; and this may encourage microcrack formation. M.W.R.

N66-39023# Joint Publications Research Service, Washington, D. C.

INVESTIGATION OF AGING KINETICS OF Al ZnMg ALLOY

I. N. Fridlyander, Ye. A. Kuznetsova, and V. S. Bubenshchikov *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 178–186 (See N66-39006 24-17) CFSTI: $7.30

An Al–Zn–Mg–Cu alloy, V-95, is found to have a very long aging period at 20°C. The preliminary zone aging is considered to have a singificant effect on subsequent aging at elevated temperatures. It is concluded that certain zones undergo allotropic transformations into metastable particles, which have greater thermal stability than particles which are nucleated directly into the matrix. A ternary alloy of the Al–Zn–Mg system was found to have the same general aging characteristics of the quaternary alloy. Changes in mechanical properties at various aging temperatures are graphed. M.W.R.

N66-39024# Joint Publications Research Service, Washington, D. C.

WELDABILITY OF HIGH STRENGTH ALLOYS OF THE AL-ZN-MG-CU SYSTEM

I. N. Fridlyander, T. A. Vlasova, Yu. N. Skachkov, N. V. Shiryayeva, Yu. I. Surkova et al *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 187–194 refs (See N66-39006 24-17) CFSTI: $7.30

Crystallization crack formation during fusion welding of high strength V-96 alloys of the Al–Zn–Mg–Cu system can be decreased by using Al–Mg welding rods. Crack formation, however, is still higher than for Al–Mg alloys. There is a significant weakening of metal in the seam zone of the V-96 type alloys; and strength coefficients of butt welded joints are 0.5 to 0.6% of the original bulk materials. Welded joints from V-96 exhibit lower creasing angle than do any other weldable aluminum alloys. Lowering Zn and raising Mg concentration of the bulk metal and the welding wire will increase the plasticity of the welded joints as well as the structural strength of the V-96 materials. M.W.R.

N66-39025# Joint Publications Research Service, Washington, D. C.

INVESTIGATION OF THE STRUCTURE OF WELDED JOINTS OF THE V-96 TYPE ALLOY

M. Ye. Drits, I. N. Fridlyander, E. S. Kadaner, A. A. Vashchenko, and N. V. Shiryayeva *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 195–206 refs (See N66-39006 24-17) CFSTI: $7.30

The effect of individual alloying elements on the structure of welded joints of V-96 alloys is investigated, as is the relationship between hot crack formation and the structure of the transition zone of welded joints. Transition zone structure differs from that at the center of the seam by the large accumulation of secondary excess phases along grain boundaries which usually form a solid lattice. The coarser the zone structure, the greater the tendency for crack formation during welding; and, conversely, there are lower cracking coefficients for finer grain zones. Temperature and rate of welding can alter grain structure. M.W.R.

N66-39026# Joint Publications Research Service, Washington, D. C.

[EFFECT OF MANGANESE AND ZIRCONIUM ON HOT BRITTLENESS OF THE Al–Mg–Zn ALLOYS]

A. Ye. Semenov, I. I. Novikov, V. S. Zolotarevskiy, and A. S. Mamin *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 207–213 refs (See N66-39006 24-17) CFSTI: $7.30

Introduction of manganese into Al–Mg–Zn alloys leads to a significant increase in hot brittleness, decrease of relative elongation, and increase of linear shrinkage. Addition of 0.12 to

0.25% zirconium increases relative elongation and resistance to crystallization crack formation. It is noted that increasing the Zr content to more than 0.15 or 0.17% is accompanied by liberation of intermetallic phases during crystallization; and this lowers the plasticity of both the cast and deformed metal, and increases thermal stresses in the welded structure. M.W.R.

N66-39027# Joint Publications Research Service, Washington, D. C.

MECHANICAL PROPERTIES OF SEMIFINISHED PRODUCTS AND WELDED JOINTS OF THE HIGH STRENGTH ALUMINUM ALLOY V92TS

K. S. Pospelov, A. Ya. Chernyak, and A. V. Sverdlin *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 214–227 refs (See N66-39006 24-17) CFSTI: $7.30

Mechanical testing is reported for a high strength aluminum alloy (V-92Ts) is pressed shapes, forgings, and stampings. Strength of these semifinished products that are naturally aged for 12 to 75 days increases from 5 to 7 kg-force/mm^2; relative elongation increases up to 1%. Greatest strength was seen in specimens tempered and artificially aged at 1000°C for 96 hr, while lowest strength resulted from 24-hr aging at 60°C and 2-hr aging at 200°C. Relative elongation is greatest from natural aging of more than 30 days, and lowest at 100°C for 96 hr. Welded joints that are first tempered and aged also increase in strength; and strength of stamped specimens is higher than that of forged specimens. Highest strength and lowest plasticity are evidenced by specimens welded with V-92sv wire, whereas AMg4 welding wire produces lowest strength and greatest plasticity. Data indicate that the alloy can be satisfactorily welded manually by argon arc, and that the strength of the welded joints is 0.74 to 0.91 of that of the bulk material. M.W.R.

N66-39028# Joint Publications Research Service, Washington, D. C.

RESIDUAL STRESSES IN WELDED JOINTS OF ALUMINUM ALLOYS

N. A. Loktionova, Yu. F. Ovchinnikov, Ye. A. Nikonorov, V. N. Zamolodchikova, L. V. Lapina et al *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 228–233 refs (See N66-39006 24-17) CFSTI: $7.30

Effects of artificial aging and annealing of welded joints on the magnitude of residual stresses was investigated in various structures made from an aluminum alloy, ATsM. Stretching longitudinal stresses were developed in the welded seam zone with magnitudes of between 10 and 11 kg-force/mm^2; and transverse compressing stresses were up to 11 and 12 kg-force/mm^2. The magnitude and nature of these residual stresses are not changed after artificial aging for 100 hr at 90°C, but increases in longitudinal stresses are observed following annealing of the welded seam zone by induction heating to 240° or 250°C for 4 to 5 min and water cooling of the seam zone. M.W.R.

N66-39029# Joint Publications Research Service, Washington, D. C.

PRODUCTION OF HIGHLY DISPERSED ALUMINUM ALLOY BY THE ELECTRICAL CORROSION METHOD

S. B. Ainbinder, N. G. Andreyeva, and E. F. Rastrigina *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 234–246 refs (See N66-39006 24-17) CFSTI: $7.30

Highly dispersed aluminum powder was produced with various controllable amounts of oxides by means of electrical erosion in a high frequency discharge. About 20% of the particles, ranging in size from 0.2 to 15 μ, result from the actual dispersion process; while condensation processes produce the bulk of the particles, which range in size from 0.01 to 0.2 μ. The electrical method consisted of pulverization in a high frequency spark discharge in a liquid medium. Maximum content of metallic aluminum in the powder was 82%. The dispersing medium was found to significantly affect the dispersity of the metal and the chemical composition of the powder produced; and, although chilled distilled water was used in some experiments, ethanol was found to be the most suitable dispersion medium. M.W.R.

N66-39030# Joint Publications Research Service, Washington, D. C.

PRODUCTION OF SUBDISPERSED METAL POWDERS BY EVAPORATION IN ARGON

L. S. Palatnik, I. N. Fridlyander, G. V. Fedorov, N. S. Klyagina, S. S. D'yachenko et al *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 247–254 refs (See N66-39006 24-17) CFSTI: $7.30

Volume of condensation of subdispersed metallic powders produced during evaporation in an argon atmosphere is found to be limited, and is a function of the rate of evaporation of the metal itself and the inert gas pressure in the condensation zone. Increasing evaporation rate and gas pressure leads to a decrease of the partial mean free path and, consequently, a decrease in the size of the condensation zone. Because of this, during the evaporation of cadmium, magnesium, and zinc the mean particle size formed is 1×10^{-3} mm. Evaporation rate and inert gas pressure have little effect on size of particles formed during the evaporation of aluminum and copper, however, and these particles are on the order of 5×10^{-5} mm. M.W.R.

N66-39031# Joint Publications Research Service, Washington, D. C.

PRODUCTION OF SURFACE LAYER SIMILAR TO SAP

S. B. Ainbinder, A. Ya. Loginova, and E. Rastrigina *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 255–262 refs (See N66-39006 24-17) CFSTI: $7.30

A mechanism is proposed to explain the formation of an SAP (sintered aluminum powder) layer on an aluminum surface which is processed with a rotating wire brush; and the hardness, chemical composition, and rigidity of this layer were investigated. Hardness of the surface layer increased from 145 to 200 kg-force/mm^2 when the diameter of the brush was decreased from 0.4 to 0.12 mm; and this increase is attributed to an increase in oxide content of the layer. Possibilities of alloying the surface layer are discussed in terms of heating and the plasticity of the brush material used. M.W.R.

N66-39032# Joint Publications Research Service, Washington, D. C.

ALUMINUM POWDER FOR HIGH STRENGTH SAP

Ye. M. Levarenko, M. G. Stepanova, L. A. Sural', N. I. Kolobnev, and G. P. Zenkov *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 263–268 refs (See N66-39006 24-17) CFSTI: $7.30

Production technology is described for the development of high strength sintered aluminum powders (SAP); and two such powders were developed: (1) APS-3, which has 13 to 18% Al_2O_3, and (2) APS-4, which has 18 to 23% Al_2O_3. These two powders result in high strength SAP compounds which can replace steel and titanium alloys operating at 350° to 500°C. Characteristics of the aluminum powder and concentration of aluminum oxide in them are shown in relation to the duration of grinding and the amount of stearic acid added. M.W.R.

N66-39033# Joint Publications Research Service, Washington, D. C.

PROPERTIES OF SAS WITH LOW LINEAR EXPANSION COEFFICIENT

R. A. Krivenko, N. S. Klyagina, N. D. Tsabrov, and I. N. Fridlyander *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 269–274 ref (See N66-39006 24-17) CFSTI: $7.30

Data are presented for SAS-1, the alloy of the Al-Si-Ni system which is reported to have the lowest linear expansion coefficient. semifinished specimens of this alloy were produced by first preparing a powder, sintering the powder under pressure, and then pressing. Maximum plasticity in SAS-1 is in the 450° to 530°C interval, and plasticity decreases as the rate of deformation provided unsatisfactory in terms of contamination to the powder. M.W.R.

N66-39034# Joint Publications Research Service, Washington, D. C.

DILATOMETRIC INVESTIGATIONS OF THE BINARY Al-Zn ALLOYS

N. P. Nuss and I. N. Fridlyander *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 275-284 refs (See N66-39006 24-17) CFSTI: $7.30

Linear expansion coefficients of binary Al-Zn alloys were investigated over a wide temperature range as a function of phase transformations to determine the relationship between chemical composition of the alloy and its linear expansion property. In all of the temperatures, from 20° to 500°C, an increase in Zn concentration produces an increase in linear expansion coefficient. Further, as the temperature itself is increased, a gradual increase in this coefficient is noted. The dependence of coefficient on chemical composition, however, does not follow the law of additivity. M.W.R.

N66-39035# Joint Publications Research Service, Washington, D. C.

CORROSION STABILITY OF NEW SINTERED ALUMINUM ALLOYS

V. S. Komissarova, A. F. Kireyeva, N. S. Klyagina, and R. A. Krivenko *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 285-291 (See N66-39006 24-17) CFSTI: $7.30

Pressed rods of sintered aluminum alloys, with varying degrees of other elements, were investigated to determine their corrosion stability. Most of the alloys had large quantities of silicon, lesser quantities of nickel, and small amounts of other elements. Two alloys with about 30% silicon exhibited the same stability under atmospheric conditions as an aluminum alloy without any silicon. Strength losses are reported at 28% after three years. Another alloy, with 13.4% Si and 16.25% SiC, has greater corrosion stability than either of the 30% silicon alloys when totally immersed in a 3% solution of NaCl The high-content Si alloys are found to be effective cathodes. M.W.R.

N66-39041# Joint Publications Research Service, Washington, D. C.

CORROSION STABILITY OF SAP MATERIAL

V. S. Komissarova, A. F. Kireeva, M. G. Stepanova, and I. N. Fridlyander *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 339-352 refs (See N66-39006 24-17) CFSTI: $7.30

Corrosion stability of sintered aluminum powder (SAP) is investigated as a function of aluminum oxide and iron content. It is found that iron content must be limited to 0.2%, since it has an unfavorable effect and quantities greater than this decrease relative elongation under atmospheric conditions by an average of 25 to 30%. Aluminum oxide, which may also be viewed as a cathode inclusion, has a very insignificant effect in 3% NaCl solution. When the SAP is anodized in sulfuric acid, a satisfactory anode film is obtained. M.W.R.

N66-39042# Joint Publications Research Service, Washington, D. C.

PROPOSED MARKING OF ALUMINUM ALLOYS

I. N. Fridlyander *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 353-355 (See N66-39006 24-17) CFSTI: $7.30

Existing letter-numeral markings for aluminum-base alloys are discussed, and a 4-numeral system is proposed to designate such alloys in a more uniform manner. The first numeral refers to the base of the alloy, with a "1" for aluminum; and seven principal groupings are suggested. A zero in the second digit designates pure aluminum; and numerals ending in "9" are reserved for SAP (sintered aluminum powder) strengthened by aluminum oxide or aluminum foam, e.g., 1019, 1029, or 1039. Alloys of the Al-Mg-Cu and Al-Cu-Mg-Fe-Ni systems would use the second numeral of "1", e.g., 1165 would replace V-65 or 1161 would replace D-6. A second digit of "2" is reserved for alloys with Mn. "4" designate alloys whose principal elements are insoluble or poorly soluble in Al. "5" refers to alloys of the magnalium type, and "9" alloys are those which contain zinc. M.W.R.

N66-39043# Joint Publications Research Service, Washington, D. C.

BEHAVIOR OF DISSOLVED GASES DURING CRYSTALLIZATION OF ALUMINUM ALLOYS

V. S. Zasypkin and A. Ye. Semenov *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 356-362 refs (See N66-39006 24-17) CFSTI: $7.30

A comparative investigation of gas solubility in ingots and liquid metals of AMg6, V-93, V-95, and other alloys indicates that hydrogen is retained almost completely during crystallization, despite the face that there is no evidence of macroporosity. In order to improve quality of the ingots and the semifinished products produced from them, it is necessary to regulate this gas concentration according to ingot size and speed of casting. Average concentration of gas in aluminum alloys is tabulated, and thickness of grain boundaries is graphed as a function of gas saturation of liquid metal. Preliminary data indicate that increase of gas saturation lowers durability at elevated temperatures and weldability of the deformed semifinished products. M.W.R.

N66-39044# Joint Publications Research Service, Washington, D. C.

EFFECT OF THE FURNACE LINING ON THE CONCENTRATION OF SILICON IN DEFORMABLE ALUMINUM ALLOYS

M. M. Rutman, G. V. Cherepak, and V. S. Rudenko *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 363-371 ref (See N66-39006 24-17) CFSTI: $7.30

A relationship is established between the intensity of melt interaction and the furnace lining in terms of metallic content of the alloy used, and some results are discussed for aluminum alloys in aluminum silicate refractories. Addition of Mg or Zn, or both elements, to Al causes an increase in Si in the alloy becauuse of the development of a reduction process. Addition of Zr and Ti in small amounts have practically no effect on the interaction, whereas Be and Mn lower significantly the interaction of the melt with fire brick. A comparison is made of the chemical stability of fire brick and of high refractories containing between 45 and 62% Si, and it is recommended that aluminum silicate refractories be used which contain at least 45% Al_2O_3. M.W.R.

N66-39045# Joint Publications Research Service, Washington, D. C.

HIGH STRENGTH CORROSION RESISTANT ALLOY V91

Ye. I. Kutaytseva, V. S. Komissarova, I. V. Butusova, N. V. Yegorova, and R. P. Usacheva *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 372-377 refs (See N66-39006 24-17) CFSTI: $7.30

High static and dynamic strength properties and relatively high corrosion stability are found for semifinished products made from V-91 aluminum alloy, which contains Cr, Cu, Mg, Mn, and Zn. Ingots 70 mm in dia were cast by a semicontinuous method, homogenized at 460°C for 24 hr, and then pressed into rods of 10 and 20 mm dia. For alloys containing up to 2.5% Mg, air tempering produces a slightly lower tensile strength than does quenching in water; and relative elongation is relatively unchanged. With increase in Mg content, yield point decreases more during air tempering than with water tempering. Introduction of Cu

increases sensitivity to cooling rate during tempering. Corrosion pits occurred following complete immersion of the specimens in 3% NaCl for a period of 3 months; and losses due to fatigue are 28.5% for the V-91 alloy. M.W.R.

N66-39046# Joint Publications Research Service, Washington, D. C.
INVESTIGATION OF COLD DEFORMATION OF SEMI-FINISHED PRODUCTS FROM V95-2 ALLOYS
G. Ye. Gol'dbukht, L. I. Mal'tseva, B. D. Shil'meyster, and V. A. Chunarev *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 378-384 (See N66-39006 24-17) CFSTI: $7.30

Sheet material made from V-95-2 alloy in thicknesses between 1.5 and 4 mm can be stamped, formed, and subjected to profiling operations with curvature radii more than twice the curvature thickness. For tempered and artificially aged specimens with wall thicknesses between 1.0 and 1.5 mm, bending can take place with a curvature radius up to 130 mm, rolling with stretching and setting of a vertical shape up to 90 mm, cutting with deformation up to 40%, and beveling at an angle as great as 15 degrees. The cold deformation process described is considered feasible for this alloy of the Al-Zn-Mg-Cu system, which contains between 2 and 5% zinc. M.W.R.

N66-39047# Joint Publications Research Service, Washington, D. C.
THE USE OF AD33 DEFORMABLE ALUMINUM ALLOY FOR THE PRODUCTION OF LARGE PARTS FOR OPERATION IN SEA WATER
N. M. Edel'man, A. M. Petrunin, V. N. Shkrof, Z. I. Starostina, and N. I. Gudkov *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 385-397 (See N66-39006 24-17) CFSTI: $7.30

An investigation of the production technology for a deformable aluminum alloy, AD-33, indicates that high stability is obtained in large forgings subjected to static loading and stress corrosion. The material exhibits low sensitivity to industrial heating, high static strength, and good fatigue resistnce. The material is, therefore, recommended for use in the production of high load carrying parts which are intended for applications in salt water. M.W.R.

N66-39050# Joint Publications Research Service, Washington, D. C.
HEAT TREATMENT OF PARTS MADE DROM AK6 ALUMINUM ALLOY IN HOT MEDIA
N. A. Loktionova, V. I. Kulakov, and V. I. Isayev *In its* Aluminum Alloy Res. in the USSR 27 Sep. 1966 p 420-430 refs (See N66-39006 24-17) CFSTI: $7.30

Mechanical properties, corrosion stability, and microstructure are investigated as a function of heat treatment for pressed work blanks and stampings made from an aluminum alloy, AK-6, which contains quantities of Cu, Mg, Mn, Si, and Ti. During tempering in a hot medium there is a slight decrease in mechanical properties, which is attributed to the decomposition of solid solution along the grain boundaries. As a result, materials with fine grain structures and well-developed substructures are more sensitive to changes in cooling rate than are products with large grain recrystallized structures. Overall corrosion and stress corrosion stability are about the same after tempering in a hot medium as after ordinary tempering followed by artificial aging. Warpings in materials quenched in the hot medium are somewhat fewer than usually occurs, which decreases rejects due to deformation and increases quality. M.W.R.

N66-39185# Los Alamos Scientific Lab., N. Mex.
MEASUREMENT OF ALPHA PHASE PLUTONIUM IN PLUTONIUM-1 W/O GALLIUM ALLOY BY ELECTRICAL RESISTIVITY
J. W. Anderson and R. R. Gilmore [1966] 27 p refs
(Contract W-7405-ENG-36)
(LA-3332) CFSTI: HC $2.00/MF $0.50

Electrical resistivity measurements have been successfully used to detect the presence of alpha-phase Pu in nominally delta-stabilized alloys. The results compare favorably with those obtained by the density and metallographic methods. Author (NSA)

N66-39250# Argonne National Lab., Ill.
THE BETA-ALPHA TRANSFORMATION IN HIGH-PURITY PLUTONIUM
M. Rosen, R. G. Peterson, and L. T. Lloyd Feb. 1966 87 p refs
(Contract W-31-109-ENG-38)
(ANL-7135) CFSTI: HC $3.00/MF $0.75

The beta → alpha transformation in high-purity Pu metal was investigated by an ultrasonic-pulse method under both quasi-equilibrium and isothermal conditions. Concurrent observations of sound velocities and relative ultrasonic attenuation yielded information on the kinetics and the mechanism of the transformation. The behavior was consistent with a displacive, or martensitic-type, transition. The time-temperature-transformation (TTT) diagram displayed two branches. The high-temperature region, above 313°K, exhibited an athermal character that extrapolated to zero beta → alpha isothermal transformation at 367°K for the purity of the metal used in the present study. Effects of multiple cycling through the $\alpha \rightleftarrows \beta$ transformation and of interrupted quenching are discussed. Structural damage due to the formation of microvoids and cracks was more extensive in specimens transformed at temperatures in the upper region of the TTT diagram. Anomalies in the sound velocities and attenuation were encountered at 200°K and at about 350°K during slow heating. The possibility of the anomalies at 350°K being caused by a recovery process is discussed. Author (NSA)

N66-39367# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SPECIFIC HEAT OF TANTALUM IN THE TEMPERATURE RANGE 1200-2900°K
Ya. A. Kraftmakher *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 276-281 refs (See N66-39346 24-23) CFSTI: HC $7.00/MF $1.50

Measurements of the specific heat of tantalum at high temperatures were conducted on wire samples by the modulation method. A formula is presented for specific heat calculations, but it is noted that for temperatures above 2000°K there occurs an additional increase of specific heat due to the formation of crystal lattice vacancies. By extrapolation of the results from temperature measurements below 2000°K, the additional specific heat was determined and correlated with the formation of vacancies. A.G.O.

N66-39428# Joint Publications Research Service, Washington, D. C.
PROPERTIES OF IRON PURIFIED BY ELECTRON-BEAM ZONE MELTING
V. I. Shiryayev and V. D. Pautov *In its* Soviet Electron-Beam Technol. 21 Sep. 1966 p 6-10 refs Transl. into ENGLISH from Fiz. Metal i Metalloved. (USSR), v. 20, no. 4, Oct. 1965 p 566-569 (See N66-39326 24-15) CFSTI: $1.00

An electron beam zone melting refining technique was used to determine the mechanical and physical properties of several intermediate metals with an OTsk lattice. Iron, nickel, vanadium, niobium, molybdenum, tungsten, and copper were studied and it was found that all metals, except iron, were obtained in the form of monocrystals after two passes. The percentage of impurities in pure iron subjected to zone refining and electron beam zone melting, and a condensate from the inside surface of the focusing plates after two passes with

zone refinement, was determined. Spectral analyses showed that the condensate had a higher percentage of Cu, Mn, and Si. The ratio $R_{300°K}/R_{4.2°K}$ of the electrical resistance of the original iron specimen and for the initial section after four passages, was determined. It was found that the residual electrical resistance of the purified iron was less over the entire length than that of the initial iron. Data from elongation curves made at 300° K and 70° K were used to determine the yield point, ultimate strength, and the character of elongation of pure and refined iron rods. It was shown that with a reduction in temperature, the yield point of refined iron increased to a lesser extent than that of the initial iron, and as the rate of deformation decreased, the difference between the yield point of refined iron at liquid nitrogen temperatures and at room temperature was sharply reduced. S.C.W.

N66-39430# Bureau of Mines, Berkeley, Calif.
HIGH-TEMPERATURE HEAT CONTENT OF LITHIUM COLUMBATE
L. B. Pankratz and E. G. King 1966 16 p refs
(BM-RI-6862)

The heat content above 298.15°K of ferroelectric lithium columbate ($LiCbO_3$) was measured to 1770°K. The Curie temperature was determined to be 1450°K, the melting point 1540°K, and the heat of fusion 16.94 kcal/mole. Heat content and entropy increments have been tabulated for the temperature range from 298.15° to 1800°K. Heat contents are also given in equation form. Author

N66-39468# Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.
STORED ENERGY IN DISPERSION STRENGTHENED ALLOYS Semiannual Report
Lincoln L. S. Chin and Nicholas J. Grant Jun. 1966 17 p refs
Repr. of an article presented at the Bolton Landing Conf., Lake George, N. Y.
(Contract Nonr-3963(18))
(AD-637257) CFSTI: HC $1.00/MF $0.50

A high value of stored energy (0.41 cal/g) was determined experimentally to persist in oxide dispersed alloys to high temperatures. This high value of stored energy is related to the retained high temperature strength of the alloy in the same temperature interval. Theories of the yield stress which take into account the presence of the dispersoid particles are still inadequate to explain the strengthening observed; suggesting the need for much additional experimental and theoretical work. Author (TAB)

N66-39470# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOLDERING TITANIUM ALLOYS FOR MEDICAL EQUIPMENT
N. F. Belavin and V. G. Shakhmatov 21 Mar. 1966 9 p refs
Transl. into ENGLISH from Med. Prom. SSSR (Moscow), no. 5, 1964 p 51-53
(FTD-TT-65-1998; TT-66-62089; AD-637389) CFSTI: HC $1.00/MF $0.50

A nickel-phosphorus covering makes it possible to reliably join parts from titanium alloys both to stainless steel and to titanium by light soldering without application of a protective atmosphere. The titanium alloys VT5-1, OT4-1 and VT14 should find application for parts of medical apparatuses and instruments, especially where high corrosion resistance, neutrality to tissues of a living organism, strength and low specific weight are required. Author (TAB)

N66-39483# Massachusetts Inst. of Tech., Cambridge. Casting and Solidification Section.
EFFECTS OF SOLIDIFICATION VARIABLES ON THE STRUCTURE OF ALUMINUM BASE INGOTS
G. E. Nereo and M. C. Flemings 1 Aug. 1966 167 p refs
(Contract DA-19-020-ORD-5706(A))
(AD-637783) CFSTI: HC $5.00/MF $1.00

The work comprises a theoretical and experimental study of macrosegregation in solidification of ingots and castings. A general expression is given for macrosegregation, which is viewed as resulting from mass flow into, or out of, local regions of the ingot during solidification. The mass flow considered in detail results from flow of solute rich liquid to feed solidification and thermal contraction. TAB

N66-39484# Oklahoma Univ. Research Inst., Norman.
SYSTEMS FOR OPTICAL LIFETIME STUDIES IN VAPORIZED METALS ESPECIALLY LITHIUM
Haruo Shintani Mar. 1966 116 p refs
(Contract AF 49(638)-639; Grant AF-AFOSR-62-378)
(AFOSR-66-1439; AD-637485) CFSTI: HC $4.00/MF $0.75

A beam technique is proposed for the measurement of atomic or molecular radiation lifetimes, and is analyzed in some detail. Practical considerations in using the proposed technique for the study of lithium are described. Author (TAB)

N66-39492# Brown Univ., Providence, R. I. Div. of Engineering.
FIELD ION MICROSCOPY AND A STUDY OF THE TUNGSTEN-CARBON ALLOY SYSTEM
R. D. French and M. H. Richman Aug. 1966 71 p refs
(Contract ARPA SD-86)
(E-33; AD-637748) CFSTI: HC $3.00/MF $0.75

The Field Ion Microscope has the highest resolution yet attainable; its magnification power being of the order of 10^6X. A review of technique and theory shows that the microscope has a builtin capability of searching a specimen along a third dimension by removal of surface atom layers, using the FIM to study the tungsten-carbon alloy system. This technique of evaporation allows one to investigate the distribution of carbon about slip bands and the distortion of the tungsten host lattice due to the presence of the carbon interstitial. A model is presented for determining carbon content in carburized specimens. The presence of carbides is discussed along with the effect of the interstitial atom on the tungsten surface layer. Suggestions for improvement and extended work are presented. Author (TAB)

N66-39527*# General Electric Co., Cincinnati, Ohio. Space Power and Propulsion Section.
MATERIALS FOR POTASSIUM LUBRICATED JOURNAL BEARINGS Quarterly Progress Report No. 10, 22 Jul.-22 Oct. 1965
R. G. Frank, ed. [1965] 171 p refs
(Contract NAS3-2534)
(NASA-CR-72027) CFSTI: HC $5.00/MF $1.00 CSCL 11F

Various candidate bearing materials, exposed to potassium for 1000 hours at 800°, 1200°, and 1600°F were examined metallographically and by X-ray diffraction analyses for microstructural changes or evidence of attack. Only carboloy 999 and Zircoa 1027 exhibited corrosive reactions and showed a transfer of carbon to the Cb-1Zr container wall after 1200°F and 1600°F exposure; a distinct layer of CbC on the ID surface of the encapsulating walls was identified metallographically. Chemical analyses of the inner 0.020-inch layer in the liquid region of the Cb-1Zr alloy capsule which contained Carboloy 907/Mo-TZM alloy test specimens found a 210 ppm increase in carbon content. The test facility for the liquid potassium friction and wear test rig was modified and almost completed. G.G.

N66-39540*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DEPOSITION OF THIN FILMS BY ION PLATING ON SURFACES HAVING VARIOUS CONFIGURATIONS

Talivaldis Spalvins, John S. Przybyszewski, and Donald H. Buckley Washington, NASA, Nov. 1966 12 p refs
(NASA-TN-D-3707) CFSTI: HC $1.00/MF $0.50 CSCL 11F

Thin gold films were ion plated on a variety of objects that have complex surface configurations. This process was performed on various substrate materials without rotating or moving the objects. Ion plating is unique in the respect that sputtering and ion deposition take place simultaneously. Because of the peculiar characteristics of the glow discharge (cathode dark space) during ion plating, the object can be uniformly plated on all surfaces. A strong bond is formed between the film and the substrate since the surface is continuously cleaned before and during the deposition process. This method may be of particular interest in the lubrication and friction field in depositing thin, soft metal films as lubricants. A number of system components that have surfaces sliding against each other (bearings, gears, and seals) can be plated with a uniform metal film. In the corrosion field, ion-plated films may be employed to protect various complex surface configurations against corrosion or oxidation. The ion-plating method has an almost unlimited range of applications. Author

N66-39542*# North American Aviation, Inc., Canoga Park, Calif.
SOLUBILITY STUDIES OF ULTRA PURE TRANSITION ELEMENTS IN ULTRA PURE ALKALI METALS
R. L. Mc Kisson, R. L. Eichelberger, R. D. Dahleen, J. M. Scarborough, and G. R. Argue Washington, NASA, Oct. 1966 154 p refs
(Contract NAS3-4163)
(NASA-CR-610) CFSTI: HC $3.25/MF $1.00 CSCL 11F

The solubilities of iron, molybdenum, niobium, and tantalum in liquid potassium were studied in the temperature range 800–1200°C, with emphasis on achieving a true two component experimental system. To this end, triple-pass electron beam zone-refined single crystals of Mo, Nb, and Ta, and triple-pass electron beam zone refined polycrystalline Fe were used as solute materials, and formed into crucibles. Least squares curves were fitted to the data, using six points for Fe at 800–1000°, six points for Mo at 1000–1200°, and twelve points for Ta at 800–1200°. ΔH of solution from these curves is 7700 cal/mol, 25,500 cal/mol, and 13,200 cal/mol for Fe, Mo, and Ta, respectively. The high values for Mo and Ta suggest that there may be a reaction involved in the solution process. Twelve measurements for Nb at 1000–1200° showed a scatter between 15 and 171 wppm, and no curve was determined. Two experiments were completed with Nb–1% Zr alloy, at 1000° and 1200°. The niobium concentration found was <1 wppm (not detected) and 6 wppm, respectively. Author

N66-39569# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SYSTEM NIOBIUM–TUNGSTEN–MOLYBDENUM–ZIRCONIUM
Ye. M. Savitskiy and A. M. Zakharov 22 Apr. 1966 16 p refs Transl. into ENGLISH from Zh. Neorg. Khim. (Moscow), v. 9, Issue 10, 1964 p 2424–2432
(FTD-MT-65-235; TT-66-62071; AD-637375) CFSTI: HC $1.00/MF $0.50

By microscopic methods, the determination of the melting point, micro hardness, and X-ray methods the structure of six primary sections of the tetrahedron niobium - tungsten - molybdenum -zirconium, parallel to the edge of the ternary system tungsten - molybdenum - zicronium, and also a number of secondary sections were studied; the investigated alloys contained totals of 5; 7.5; 10; 15; 20; and 30 wt.% of tungsten, molybdenum and zirconium, the remainder being niobium. Projections were constructed of the surfaces of the solidus curve and also the isotherm of cited primary sections at temperatures of 2000°, 1800°, 1500°, and 1100°C. The investigated alloys had a single-phase or two-phase structure; single-phase alloys constituted quaternary solid solutions of tungsten, molybdenum, and zirconium in niobium, and in the structure of the two-phase alloys there were also observed crystals of the excess phase (W, Mo)^{2}Zr. A three-dimensional projection of the quaternary system niobium - tungsten- molybdenum - zirconium was constructed in the form of a polythermic tetrahedron, making it possible to explain the processes of crystallization of the various alloys and their structure in the solid state. Author (TAB)

N66-39589# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THERMODYNAMIC STABILITY OF MONOCARBIDES OF TRANSIENT METALS OF IV-VI SUBGROUPS
R. G. Avarbe 23 Feb. 1966 20 p refs Transl. into ENGLISH from Poroshkovaya Met., Akad. Nauk Ukr. SSR (Kiev), no. 2, 1965 p 41–49
(FTD-TT-65-1382; TT-66-62082; AD-637381) CFSTI: HC $1.00/MF $0.50

An analysis was made of the data in the literature on the state diagrams in systems of transition metal of subgroup IV-VI - carbon by the dependence of the heats of formation, energies of activation and coefficients of activity of monocarbide phases on the position of the metal in the periodic system, as well as data on evaporability Author (TAB)

N66-39664# Stanford Univ., Calif. Dept. of Materials Science.
STUDIES ON CRYSTALLINE IMPERFECTIONS IN METALS Final Report, 1 Mar. 1958–28 Feb. 1965
Robert A. Huggins Jun. 1966 23 p refs
(Contract Nonr-225(34))
(SU-DMS-66-16; AD-637774) CFSTI: HC $1.00/MF $0.50

The research program was initiated in order to study the problem of the mechanism or mechanisms by which dispersions of a stable second phase affect the deformation and annealing behavior of metals. In addition to studies directly associated with dispersions, a number of other investigations were conducted relating to various other aspects of the behavior of crystalline imperfections in metals. The significant results are indicated very briefly by reference to previous Technical Reports, papers published in the general technical literature, and Ph.D. dissertations that were either partially or wholly supported by this contract. Copies of the abstracts of the papers and the dissertations are appended Author (TAB)

N66-39714*# Michigan Univ., Ann Arbor. Lab. for Fluid Flow and Heat Transport Phenomena.
FURTHER CAVITATION DAMAGE CHARACTERISTICS IN A CAVITATING VENTURI USING WATER AND MERCURY AS TEST FLUIDS Technical Report No. 20
M. J. Robinson, F. G. Hammitt, J. F. Falferty, and R. Garcia Sep. 1966 79 p refs *Its* Rept.-03424-20-T
(Grant NsG-39-60)
(NASA-CR-78964) CFSTI: HC $3.00/MF $0.75 CSCL 11F

Data are presented to document investigations on several aspects of cavitation damage characteristics and cavitating flow regimes. These include experimental programs on photomicrographic cross sections of materials from venturi damage tests; pitting in plexiglass; zero cavitation and continuous 100 hour runs; handling and storing procedure checkout; and electron microscope photomicrographs. Ultimate resilience correlations, based on a least mean square fit regression analysis, are also discussed. Among the major conclusions reached are: (1) There is no visible corrosion on test specimen surfaces sectioned from the water system tests; however, there was corrosion on the carbon steel specimens which were not sectioned. No corrosion was evident for the specimens from the mercury tests. (2) The usual pits observed on plexiglas specimens from the water system tests support the liquid jet damage hypothesis as opposed to the shock wave

hypothesis. (3) The best single property correlation between the material properties and cavitation volume loss for the mercury tests was obtained with the ultimate resilience, which appeared to the 1/2 power. M.G.J.

N66-39740# Boeing Co., Seattle, Wash. Aerospace Group.
MACROLAMINATE PARTICLE COMPOSITE MATERIAL DEVELOPMENT Summary Report, 1 Jun. 1965–1 Jul. 1966
F. H. Simpson. Jul. 1966. 74 p. refs
(Contract NOw-65-0403-d)
(AD-637573) CFSTI: HC $3.00/MF $0.75

Nickel-alumina was used as a model system to demonstrate the validity of the Knapp-Shanley concept for combining ductile and brittle materials into composites exhibiting stress relief capability not obtainable in the brittle material alone while achieving improved specific strength and stiffness characteristics not available in the metal. Ni-Al2O3 composites having 3 times the specific strength and 1.5 times the specific stiffness of nickel and impact strength 3 to 5 times that of alumina were produced. These composites retained from 60 to 90 percent of their strength when water quenched from 2000F; alumina cracked and had no strength retention after the same quenching. At 2000F the nickel has essentially zero strength while NiAl2O3 composites maintained a flexural yield strength in excess of 20 ksi. Substitution of higher strength nickel alloys for pure nickel produced significant improvements in the properties of the composite. Flexural strength of 32 ksi at 2000F and 16 ksi at 2400F were obtained in a (Ni . 2ThO2) 13Cr - Al2O3 laminate particle composite. This composite gained 2 mg/sq cm and 8 mg/sq cm after 100 hour exposure at 2000 and 2400F, respectively, which is 1/5 that of TD nickel. TAB

N66-39748# Dayton Univ., Ohio. Research Inst.
METALLURGY OF ALUMINUM INGOTS FOR HYPERVELOCITY IMPACT TARGETS Technical Report, 1 Feb.–15 Oct. 1965
Robert F. Rolsten and William A. Dean. Wright-Patterson AFB, Ohio, AF Mater. Lab., Apr. 1966. 79 p. refs
(Contract AF 33(615)-2040)
(AFML-TR-66-109; AD-637715) CFSTI: HC $3.00/MF $0.75

The information presented in this report should be considered part of the report entitled, Hypervelocity Impact Studies, Technical Report No. ML-TR-66-40. These data are believed to be important in the progress and continuous evaluation of the hypervelocity impact program conducted by the Materials Laboratory at Wright-Patterson Air Force Base. The materials is presented in five parts. The first part involves the tabulation of all the raw data from the tensile tests. The second involves photographs of the tensile specimens. The third involves photographs of the alloy grain sizes. The fourth contains a tabulation of the derived data. The fifth part involves the analysis, interpretation and discussion of the results of the tensile tests, including the effects of testing temperature, the importance of strain hardening, and the significance of the energy per unit volume. (Author) TAB

N66-39759# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN INVESTIGATION OF THE POLYGONIZATION OF MOLYBDENUM AND ITS ALLOYS
Tan Shu Song and M. L. Bernshteyn. 26 Mar. 1966. 15 p. refs
Transl. into ENGLISH from Wu Li Hsueh Pao (Peking), v. 20, no. 6, 1964. p. 528–539
(FTD-TT-65-876; TT-66-62114; AD-637441) CFSTI: HC $1.00/MF $0.50

The polygonization process of molybdenum and molybdenum alloys was investigated and the conditions of polygonization and the qualitative laws governing its development explored by applying the methods of metallography and electron microscopy. The results of the investigation verified the inhibiting effect of polygonization on the recrystallization process. At the same time, by measurement of hardness and elastic limit. The effects of polygonization on the mechanical properties of molybdenum and molybdenum alloys was investigated. The results indicate that the polygonal structure greatly improves these properties. Author (TAB)

N66-39784# Brown Univ., Providence, R. I.
EXHAUSTION OF DUCTILITY UNDER NOTCH CONSTRAINT FOLLOWING UNIFORM PRESTRAINING Fifth Progress Report
C. Mylonas, S. Kobayashi, and A. Armenakas. Washington, Natl. Acad. of Sci.—Natl. Res. Council, Aug. 1966. 50 p. refs
(Contract Nobs-88294)
(SSC-173; AD-637143) CFSTI: HC $2.00/MF $0.50

The purpose of the work was to measure the amount of uniform precompression of ABS-B and Project E-steel resulting in brittle fracture under the stron constraint of a subsequently machined severe circumferential groove. The elongation at the shoulders, measured with a special extensometer, was found to be a far more sensitive measure of brittleness than the average fracture stress. Prestrains as low as 0.05 caused a reduction of the elongation at the shoulders from about 0.017 - 0.050 in. to about 0.003 - 0.006 in. At low prestrains average fracture stress equaled or exceeded the theoretical flow limit of 2.68 sigma 0.1, where sigma 0.1 is the 0.1% offset yield stress in simple tension at the same prestrain. At a prestrain of 0.20 the fracture stress fell below the flow limit and at 0.60 it was close to sigma 0.1. The conditions of fracture at a notch in a strain hardening material are discussed. The total plastic elongation of a region surrounding a sharp notch in prestrained steel determines whether or not fracture will be initiated in large structures, hence is a direct and realistic measure of the remaining ductility and provides an excellent test of the materials resistance to embrittlement. Author (TAB)

N66-39791# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
EFFECT OF TUNGSTEN COMPOSITION ON THE MECHANICAL PROPERTIES OF THE W-Ni-Fe HEAVY ALLOY Interim Scientific Report
Joseph W. O'Neil and Phillip N. Salyer. Dec. 1965. 37 p. refs
(Contract AF 49(638)-1463)
(ASRL-TR-132-2; AFOSR-66-1670; AD-638620) CFSTI: HC $2.00/MF $0.50

The ductility and strength of W-Ni-Fe composites over a wide range of volume % W was investigated at room temperatures. A series of composites was prepared (40% W to 95% W), sintered in the presence of the liquid phase and tested in tension. The sources of strength and ductility of the W-Ni-Fe composite was determined as related to the measured dihedral angle, mean particle diameter, tungsten mean free path, tungsten contiguity and volume % W. Similar stress-strain curves were obtained for all specimens tested which showed liquid phase sintered microstructure. These test results indicate that the volume % has very little effect upon the composite strength. For W-Ni-Fe composites where the tungsten mean free path is greater than the measured particle diameter (approximately 85% to 96% W), the maximum strain and maximum stress at necking dropped off rapidly. Author (TAB)

N66-39816# Battelle Memorial Inst., Geneva (Switzerland).
RESEARCH TO DETERMINE THE LONG-TERM MECHANICAL PROPERTIES OF METALS SUBJECTED TO MECHANICAL STRESS AT ELEVATED TEMPERATURES AND NEUTRON IRRADIATION Annual Report, 1965
W. Siegfried and S. Zimering. Brussels, EURATOM, Aug. 1966. 21 p. refs
(Contract EURATOM-057-64-7 TEES)
(EURAEC-1621; EUR-2834.e) CFSTI: HC $1.00/MF $0.50

Graphical methods have been devised for the three classes of mechanisms leading to long-time rupture: mechanism of

deformation, growth of cracks, long-time changes in the materials These methods have been applied to the interpretation of time-to-rupture results and found to be also applicable in the case of neutron irradiated materials. Use of the exponential function of real applicable in the case of neutron irradiated materials. Use is made of the exponential function of real order to improve the representation of the shape of time-to-rupture curves. Author

N66-39819# Atomic Energy Establishment, Winfrith (England). General Reactor Physics Div.

AN ANALYSIS OF URANIUM METAL-GRAPHITE SYSTEMS USING THE MULTI-GROUP CODE "WIMS"

F. R. Barclay 2 Jun. 1966 29 p refs

(AEEW-R-473) HMSO: 4s

A wide range of uranium metal graphite lattice experiments have been studied using a code which has, in its turn, been compared with more exact calculational models in the fast and resonance energy regions. No significant errors in the calculational model were observed. Comparison with experiment shows a systematic error with pitch which is ascribed to an error of some 15% in the best available uranium-238 resonance data. Within this, different sizes and enrichments of fuel rods, and different air channel sizes (streaming) are well predicted. Author

N66-39827# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.

GROWING OF LARGE ORIENTED ALUMINIUM SINGLE CRYSTALS NON-FUSED NON-FUSED SEED CRYSTALS

A. Modrzejewski 1966 6 p refs Submitted for Publication

(INR-722/II/PL) CFSTI: HC $1.00/MF $0.50

Large oriented single crystals of aluminum were grown by the modified Bridgman method. It has been found that the attaching (fusing) of the seed crystal to the main crystal was not necessary for obtaining single crystals of controlled orientation. Author

N66-39865# Watervliet Arsenal, N. Y. Benet Labs.

THE EFFECT OF STRAIN RATE ON YIELDING IN HIGH-STRENGTH STEELS

David P. Rendall and Thomas E. Davidson May 1966 35 p refs

(WVT-6618; AD-637217) CFSTI: HC $2.00/MF $0.50

The effect of strain rates ranging from 0.0001 to 10 in/in/sec. on the yield strengths of several high strength alloy steels is investigated. Quenched and tempered type alloys exhibit two regions of strain rate sensitivity with the strain rate dividing the sensitive and insensitive regions varying from 0.5 to greater than 10 in/in/sec, depending on composition, microstructure and grain size. At the higher rates a power law relationship is found which is consistent with a yielding model involving breakaway of dislocations from solute atmospheres. Maraging steel exhibits a continuous power law strain rate sensitivity over the entire range Author (TAB)

N66-39867# National Aero- and Astronautical Research Inst., Amsterdam (Netherlands).

THE EFFECT OF "GROUND-TO-AIR CYCLES" ON THE FATIGUE CRACK PROPAGATION IN 2024-T3 ALCLAD SHEET MATERIAL

J. Schijve and P. De Rijk Jul. 1966 10 p refs Supported by the Netherlands Aircraft Develop. Board

(NLR-TR-M-2148) CFSTI: HC $1.00/MF $0.50

Constant amplitude tests and simplified flight simulation tests with 10 or 50 gust cycles per flight were performed. The effect of the ground-to-air cycle is compared with the Palmgren-Miner prediction. Optical and electron microscope observations of the fracture are presented Author

N66-39870# Gt. Brit. Ministry of Aviation, London. Technical Information and Library Services.

THE INFLUENCE OF SHOT-PEENING AND SIMILAR SURFACE TREATMENTS ON THE FATIGUE PROPERTIES OF METALS. PART II: APPENDIX ON SELECTED CASE HISTORIES

F. Sherratt Feb. 1966 46 p refs

(S&T-MEMO-2/66) CFSTI: HC $2.00/MF $0.50

Nine case histories on the influence of shot peening on the fatigue properties of metals are presented, including such details as basic features, source, material, form of test piece, peening, residual stress, fatigue test results, and other reports. Tables, graphs, and figures are given to illustrate test results. L.E.W.

N66-39888*# TRW Equipment Labs., Cleveland, Ohio. Materials Research and Development Dept.

GENERATION OF LONG TIME CREEP DATA ON REFRACTORY ALLOYS AT ELEVATED TEMPERATURES Twelfth Quarterly Report, 26 Mar.–26 Jun. 1966

J. C. Sawyer and E. A. Steigerwald 15 Jul. 1966 80 p ref (Contract NAS3-2545)

(NASA-CR-72044) CFSTI: HC $2.50/MF $0.75 CSCL 11F

Research was conducted to study the long-time creep strength of various refractory metal alloys that are used in space electric power systems. The data obtained for vapor-deposited tungsten, the molybdenum base alloys TZC and TZM, columbium modified TZM, and the tantalum base alloy T-111 are presented. The compositions of the alloys are listed along with the range of test temperatures and heat treatment data. The charts showing the test data contain the time, the change in length, the percent creep, and the pressure at which the tests were conducted. H.S.W.

N66-39910*# Tennessee Univ., Knoxville. Dept. of Chemical and Metallurgical Engineering.

ON THE APPLICATION OF DIFFUSE X-RAY SCATTERING TO THE STUDY OF THE STRUCTURE OF BINARY ALLOYS Semiannual Progress Report, Mar. 1–Aug. 31, 1966

J. E. Spruiell [1966] 13 p refs

(Grant NGR-43-43-001-018)

(NASA-CR-79124) CFSTI: HC $1.00/MF $0.50 CSCL 11F

Continued research conducted under a program focusing on an experimental and theoretical study of the relationship between the local atomic arrangements in metallic solid solutions and the physical, mechanical, and thermodynamic properties of the solid solutions; is reported. Alloys from the Ni–Pd system, the Fe–Al system, and the Ni–W system, were studied. Data on the diffuse intensity distribution on the h_1h_20 plane of reciprocal space for a Ni −50 at. % Pd crystal are presented. Several measurements of the diffuse scattering from the Fe −14.5 at. % Al crystal and an Fe −19.2 at. % Al crystal were made. A list of the sample conditions and type of data collected is presented. Heat treatment measurements were made throughout a plane in reciprocal state at room temperature, 136°K, and data were collected along the h_100 line in reciprocal space at 300°K in order to evaluate the effects of numerous heat treatments. Experimentally determined values of the atomic scattering factors of iron and aluminum for Co Kα radiation are tabulated. Specific goals which were used in a study of the relationship of the local atomic arrangements in Ni-rich NiW solid solutions to their physical and thermal properties are listed. S.C.W.

N66-39970*# Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Systems Div.

PLANE STRESS CYCLIC FLAW GROWTH OF 2219-T87 ALUMINUM AND 5A1-2.5 SN ELI TITANIUM ALLOYS AT ROOM AND CRYOGENIC TEMPERATURES Final Report, 1 Jul. 1964–1 May 1966

D. A. Eitman and R. A. Rawe 1 Sep. 1966 153 p refs
(Contract NAS3-4192)
(NASA-CR-54956; DAC-59256) CFSTI: HC $3.25/MF $1.00
CSCL 11F

Fatigue crack propagation tests of flat uniaxial panels and cylindrical (biaxial) specimens were conducted at room temperature, −320° and −423°F. A broad range of stresses and crack lengths were studied at each temperature. Parametric and fracture mechanics approaches were used in analyzing the data. A parametric method was developed which permits prediction of cyclic life of a through-cracked structure, crack-growth curves, and growth rates. A correlation of uniaxial and biaxial crack-growth behavior has been established, and a method for use of plane-stress fatigue crack propagation data in tank design is presented. Author

N66-39973*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A HIGH STRENGTH NICKEL BASE ALLOY WITH IMPROVED OXIDATION RESISTANCE UP TO 2200°F
William J. Waters and John C. Freche Washington, NASA, 1966 34 p refs For Presentation at the Conf. of the Gas Turbine Div. of ASME, Houston, Tex., 5–9 Mar. 1967 CFSTI: HC $2.00/MF $0.50
(NASA-TM-X-52237) CFSTI: HC $2.00/MF $0.50 CSCL 11F

A high strength nickel base alloy has been developed which compares favorably in oxidation resistance with known high strength nickel base alloys. The alloy, although basically a cast material, also possesses workability potential. After 310 hours exposure to air at 1900°F, the alloy had a weight gain of 1.8 mg/cm^2. The total affected zone, external oxide scale plus depletion zone, was 0.4 mil. This compares with a weight gain of 3.0 mg/cm^2 and a total affected zone depth of 3.3 mils for Rene 41 after only 100 hours exposure at 1900°F. In sheet form after 8 hours at 2200°F, its oxidation resistance was approximately the same as that of Rene 41 at 1900°F. Tensile strengths of the alloy after rolling heat treatment ranged from an average of 185,000 psi at 1400°F to 3000 psi at 2200°F. Maximum elongation was 55 percent and occurred at the latter temperature. At 1900°F, average tensile strength was 64,500 psi in the as-cast condition, and 54,000 psi after rolling and heat treatment. Author

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N66-38924*# Houston Research Inst., Inc., Tex.
DESIGN DATA FOR ABLATORS. PART III: MATHEMATICAL MODEL FOR DECOMPOSITION OF PHENOL–FORMALDEHYDE ABLATORS Final Report
Charles E. Mauk, H. William Prengle, Jr., W. A. Hoppe, and M. S. Bawa 31 Mar. 1965 239 p refs
(Contract NAS9-2516)
(NASA-CR-65540) CFSTI: HC $3.75/MF $1.50 CSCL 11I

A mathematical model was formulated that describes the mechanism of pyrolysis at isothermal conditons over a range of temperatures for phenol-formaldehyde (PF) ablators. It was found that water and air adsorption from the atmosphere by PF polymers can be as much as 11w%; that the curing process is important for achieving maximum cross-linkage of the PF polymer; that a six step decomposition model describes the pyrolysis of the PF polymer; and that the transport effects are reduced at high temperatures. Measurements of the physical characteristics of the PF solids indicated large pores and a small surface area. The addition of quartz fibers to the mixture had little effect on its decomposition. Preliminary results on epoxy-novolak ablators indicated that water adsorption was much less than for PF polymers and is not a factor in initial decomposition. G.G.

N66-39290# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
UKRAINIAN JOURNAL OF PHYSICS Selected Articles
9 May 1966 47 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 9, no. 7, 1964 p 769–791
(FTD-TT-65-808; TT-66-62048; AD-637101) CFSTI: HC $2.00/MF $0.50

CONTENTS:

1. THERMOMECHANICAL PROPERTIES AND BIREFRINGENCE OF SYNTHETIC FIBERS O. Y. Golik, N. A. Rindich, and M. Yu. Kuchinka p 1–14 refs (See N66-39291 24-18)

2. DETERMINATION OF MELTING POINT OF SYNTHETIC FIBERS BY MEANS OF BIREFRINGENCE O. Z. Golik, M. Yu. Kuchinka, and M. O. Gemina p 15–24 refs (See N66-39292 24-18)

3. EFFECT OF HEAT TREATMENTS AND THERMOMECHANICAL TREATMENTS ON THE DENSITY OF SOME SYNTHETIC POLYMERS O. Z. Golik, N. A. Rindich, and M. Yu. Kuchinka p 25–39 refs (See N66-39293 24-18)

N66-39291# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THERMOMECHANICAL PROPERTIES AND BIREFRINGENCE OF SYNTHETIC FIBERS
O. Z. Golik, N. A. Rindich, and M. Yu. Kuchinka *In its* Ukrain. J. of Phys. 9 May 1966 p 1–14 refs (See N66-39290 24-18)
CFSTI: HC $2.00/MF $0.50

Results are presented of a study of the thermomechanical properties for a wide range of loads, and also of the temperature dependences of birefringence, obtained during the process of plotting the thermomechanical curves for highly-oriented fibers from polypropylene and caprone, as well as for unoriented amorphous and crystalline polyethylene–terephthalate fibers. Investigation of the birefrigence Δn for oriented fibers showed that for load values ranging from 0.7 to 30 kg/mm^2 the birefringence of caprone fiber does not change up to specimen rupture. Starting with a temperature of 120°C, the birefringence of polypropylene fiber decreases at loads up to 5 kg/mm^2. At loads above 5 kg/mm^2, Δn increases. The beginning of the increase in Δn depends on the magnitude of the drawing tension. Polarized-light observations of isotropic specimens of polyethylene terephthalate fibers showed that amorphous, as well as crystalline specimens of this fiber are deformed homogeneously along their entire length prior to the beginning of the steep rise of the thermomechanical curve. Author

N66-39292# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DETERMINATION OF MELTING POINT OF SYNTHETIC FIBERS BY MEANS OF BIREFRINGENCE
O. Z. Golik, M. Yu. Kuchinka, and M. O. Genina *In its* Ukrain. J. of Phys. 9 May 1966 p 15–24 refs (See N66-39290 24-18)
CFSTI: HC $2.00/MF $0.50

The paper describes a technique of determination of the melting point of crystalline polymers in the form of films and fibers that is based on the vanishing of the interference pattern of birefrigence. It is shown that the melting of commercial fiber specimens takes place in a wide temperature interval, amounting to 14°C for polypropylene fiber, to 3°C for caprone, and to 2°C for polyethylene terephthalate. The mean value of the temperature

of complete vanishing of birefringence (TM) is 223°C for caprone fiber, 170°C for polypropylene fiber, and 266°C for polyethylene terephthalate fiber. Measurement results showed that the melting temperature interval depends both on the degree of crystallinity and on the method of cooling the specimen. The higher the crystallinity and the better the removal of the internal stresses, the narrower will be the melting temperature interval of a crystalline polymer. Author

N66-39293# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF HEAT TREATMENTS AND THERMOMECHANICAL TREATMENTS ON THE DENSITY OF SOME SYNTHETIC POLYMERS
O. Z. Golik, N. A. Rindich, and M. Yu. Kuchinka *In its* Ukrain. J. of Phys. 9 May 1966 p 25–39 refs (See N66-39290 24-18)
CFSTI: HC $2.00/MF $0.50

The paper describes an improved technique of measurement of the density of polymer fibers and films by the method of gradient tubes. It was found that the density of unoriented amorphous fibers and films from polyethylene terephthalate increases sharply in the 115–120°C temperature region; when the temperature is further increased to 180°C, the density increases considerably. A study of cooling conditions of heated samples showed that the higher the temperature of the heat treatment, the greater will be the difference between the densities of quenched- and slowly-cooled samples. The density variation of highly-oriented crystalline samples of polyethylene terephthalate and caprone fibers that correspond to different sections of the thermomechanical curve, and of samples whose elongation is by 1–1.5% smaller than the elongation at break, showed that the smaller the load and the higher the temperature, the higher will be the density as compared to its original value. An increase in load is accompanied by a shift of the thermomechanical curve towards lower temperatures, which in turn leads to a corresponding decrease in density. Author

N66-39340*# Mellon Inst., Pittsburgh, Pa.
VISCOELASTIC BEHAVIOR OF POLYMERS AT LUNG TIMES Final Report
Donald J. Plazek 25 Aug. 1966 9 p refs
(Grant NsG-147-61)
(NASA-CR-78749) CFSTI: HC $1.00/MF $0.50 CSCL 11I

Two torsional creep apparatuses, designed to measure recoverable deformation when the total deformation is greatly dominated by viscous flow, were constructed. A float torsional creep apparatus proved to be of limited use for the measurement of linear amorphous polymers because of the small temperature range and the presence of residual torques which were believed to arise from the surface tension of the supporting oil. The second instrument built employed a magnetic suspension for the rotor, thereby eliminating the need for the supporting oil and hence the presence of surface tension forces. It proved highly successful in the measurement of total creep and creep recovery of a wide variety of materials. Among the linear amorphous polymers studied with this apparatus are several fractions of polyvinylacetate, PVAc, with different molecular weights. The viscous, viscoelastic and crystallization properties of the glass-forming hydrocarbon 1,3,5 tri-α-naphthyl benzene, TαNB were also studied in detail. R.LI.

N66-39442# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
FIXATION OF HIGH-LEVEL RADIOACTIVE WASTES IN PHOSPHATE GLASS: HOT CELL GLASS EXPERIMENT
U. L. Upson Jan. 1966 73 p refs Presented at the Symp. on Solidification and Long-Term Storage of Highly Radioact. Wastes, Richland, Wash.
(Contract AT(45-1)-1830)
(BNWL-200; CONF-660208-9) CFSTI: HC $3.00/MF $0.75

The technical feasibility of producing a phosphate glass directly from a high level aqueous fuel reprocessing waste was demonstrated. Difficulty was encountered in reconciling feed concentrator flow and adequate premelter concentration, and the actual waste behaved unlike the simulated wastes of prior studies. This was possibly due to inadequate analytical data on the feed waste and to radiolytic effects. Glass leachability was as good as that of similar cold glasses and remained constant for glass stored in dry air. Storage in moist air increased the glass leachability. After six months, microscopic exudations appeared on the surfaces of polished specimens, which could be due to a radiolytic effect or excess phosphoric acid in the initial composition. Contamination, especially by ruthenium, of the platinum melter lining penetrated throughout the metal, requiring dissolution and electrolytic seapration for platinum recovery. The inherent instability of the glassy state, especially at temperatures separation the melting point, suggests that alternative polycrystalline forms should also be investigated. R.N.A.

N66-39449# Olin Mathieson Chemical Corp., New Haven, Conn. Chemicals Div.
SiB POLYMER DEVELOPMENT Quarterly Report, 1 May–31 Jul. 1966
Hansjuergen A. Schroeder, Otto G. Schaffling, and Trescott B. Larchar 30 Aug. 1966 21 p refs
(Contract NObs-94278)
(QR-2; AD-637677) CFSTI: HC $1.00/MF $0.50

Changes in the processing methods and techniques greatly improved the physical properties of uncompounded but cured SiB-2 rubber culminating in 750% elongation. Common silicone fillers proved to be inadequate in enhancing the physical properties of SiB elastomers thus requiring a search for more effective filler materials. SiB-2 type rubber, now being prepared in 600 g. lots by bulk polymerization, must be free of even trace amounts of impurities since these adversely affect thermostability in the 800F and 900F range. SiB rubber films with satisfactory properties down to 11 mil thickness were prepared by several methods. Further progress was made regarding the general SiB elastomer development Author (TAB)

N66-39509# Marine Engineering Lab., Annapolis, Md.
DEVELOPMENT OF A WATER-BASE, FIRE-RESISTANT HYDRAULIC FLUID
C. L. Brown, T. N. Cornish, and J. A. Marzani Aug. 1966 27 p refs
(MEL-261/66; AD-637655) CFSTI: HC $2.00/MF $0.50

A corrosion-inhibited, low-pour-point, water-base fluid formulation, LF-4713, containing a soluble, fire-resistant, phosphonated polyethylene thickener, was evaluated. The fluid appears to have good fire resistance and meets many of the target requirements for a satisfactory hydraulic fluid. Its thermal instability and its tendency to form stable foams and to allow corrosion of ferrous metals in vapor spaces require correction Author (TAB)

N66-39555# Picatinny Arsenal, Dover, N. J. Plastics Technical Evaluation Center.
POLYBENZIMIDAZOLES: A REVIEW
J. Richard Hall and David W. Levi Jul. 1966 48 p refs
(PLASTEC-28; AD-637569) CFSTI: HC $2.00/MF $0.50

A review of the polybenzimidazoles is given, based on 47 references. Included is the preparation, some properties and a few applications of these polymers. (Author) TAB

N66-39604# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TESTS OF GLASS PLASTIC FOR THERMAL IMPACT

M. A. Loshkarev and M. L. Bogorad 21 Feb. 1966 8 p Transl. into ENGLISH Dokl. Nauch. Soveshch. (USSR), No. 4, 1964 p 355–358
(FTD-TT-65-1189; TT-66-62080; AD-637379) CFSTI: HC $1.00/MF $0.50

A report is given of studies which demonstrate the use of glass-reinforced plastics as high-temperature construction materials is limited not so much by temperature (which may be very high), but by the duration of its application. TAB

N66-39687*# United Aircraft Corp., East Hartford, Conn. Research Labs.
INVESTIGATION OF THE KINETICS OF CRYSTALLIZATION OF MOLTEN BINARY AND TERNARY OXIDE SYSTEMS Quarterly Status Report No. 4, Jun. 1–Aug. 31, 1966
James F. Bacon 30 Sep. 1966 73 p refs
(Contract NASw-1301)
(NASA-CR-78992) CFSTI: HC $3.00/MF $0.75 CSCL 11B

A summary is presented of the results from a program to investigate the essentials of glass formation by measuring the rate at which crystallization occurs and the effects of anti-nucleating agents on the observed crystallization rate for systems which tend to form complex three dimensional structures. The systems studied included cordierite glasses with nucleating and anti-nucleating additives, the benitoite and beryl systems, fluoborate glasses, Morey's tantalum oxide-titania-lanthanum borate glasses, and invert glasses. The best glasses developed show an average value for Young's modulus above fifteen million psi for samples of bulk glasses without any special heat treatment; this indicates that the project goal of eighteen to twenty-one million psi is attainable. It is concluded that the approach reported appears to be promising for producing high modulus glass fibers. Recommendations for further study are made. H.S.W.

N66-39788# Picatinny Arsenal, Dover, N. J. Plastics Technical Evaluation Center.
FIBER REINFORCED THERMOPLASTICS: APPLICATIONS, MOLDING TECHNIQUES, AND PERFORMANCE DATA
Nicholas T. Baldanza May 1966 90 p refs
(PLASTEC-26; AD-637721) CFSTI: HC $3.00/MF $0.75

A review of the techniques for molding fiber reinforced thermoplastics (RTP) is presented, and the potentials for their use are discussed. RTP molding materials are available for the production of superior moldings by the use of conventional plunger and screw type injection machines. The addition of fibers generally yields a marked improvement in the physical properties of the molded product, approaching and sometimes exceeding the strength and durability of molded thermosets, some non-ferrous metals, and certain alloys. Materials chiefly applicable are: glass and asbestos fibers, and the following resins - ABS, acetals, acrylics, nylons, polycarbonates, polyethylenes, polypropylenes, styrenes, fluorocarbons, chlorinated polyethers, urethanes, polysulfones, vinyls, and lubricated thermoplastics. The properties of resin/reinforcement formulations made by several suppliers are given. The report also includes 53 references and an extensive supplemental bibliography. Appendixes mention several patents, applicable specifications, and known suppliers of RTP. Author (TAB)

N66-39792# Prodesco, Inc., Perkasie, Pa.
DESIGN OF WOVEN AND LAMINATED FABRICS FOR TESTING OF THERMAL RESISTANCE Final Report
Hal E. Brockmann Johnsville, Pa., Naval Air Develop. Center, 19 Aug. 1966 15 p
(Contract N62269-2231)
(NADC-MR-6612; AD-638560) CFSTI: HC $1.00/MF $0.50

In an effort to develop a single-layer fabric specifically constructed to resist thermal radiation of intensity commensurate with that of nuclear detonations several concepts were investigated. These concepts were: (1) air spacings incorporated in the fabric by weaving; (2) weaving into the fabric a metallic scrim to impede and spread laterally the heat passing through the fabric; and (3) incorporating an insulating layer by lamination between two fabric layers. Fabrics of good thermal resistance were obtained and certain principles with regard to thermal protection were derived from the data generated in this study together with those from earlier studies on flame contact. Foremost among the latter is the fact that air spacing is far more efficacious against heat transfer by flame contact than by radiation. Author (TAB)

N66-39920*# Rensselaer Polytechnic Inst., Troy, N. Y.
VISCOELASTICITY AND PLASTICITY CONSIDERATIONS IN THE FRACTURE OF GLASSLIKE HIGH POLYMERS
L. C. Cessna, Jr. and S. S. Sternstein Sep. Presented at a Symp. on Fracture Sponsored by the Ilikon Corp., Boston, Feb. 1966 Submitted for Publication
(Grant NsG-100)
(NASA-CR-79113) CFSTI: HC $3.00/MF $0.50 CSCL 11I

The fracture properties of amorphous, linear high polymers below the glass transition temperature and under conditions of loading such that material failure may be classified as apparently brittle, were studied. A theory is presented which treats the general, time-dependent stress concentration factor (rheological response problem). A simultaneous solution of the equation which gives the stress concentration as a function of plastic zone size and the equation which describes the rehological response of the material to localized high stress is outlined. The simultaneous solution is presented for arbitrary sample loading history and arbitrary sample rheology. Specific solutions for polymethylmethacrylate (PMMA), for the specified loading histories of creep and constant strain rate, are given and compared with experimental results. Theoretical predictions are consistent with both Griffith's and Orawan's treatments when applied to constant strain rate data for glasslike polymers. In addition, the proposed theory provides an explanation of several conceptual difficulties which arise in the application of the Griffith surface energy concept. S.C.W.

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N66-38999# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
TWO DIMENSIONAL SPECTRAL ANALYSIS
Louis J. Cote Jul. 1966 34 p *Its* Mimeograph Ser. No. 83

The measured spectra were obtained for a study on the traversability of open ground by vehicles. A theoretical outline of two-dimensional stationary processes with some possible uses of their spectra is presented, followed by the details of the statistical estimation of two-dimensional spectra. Measurement errors, noise, and their detection and correction are discussed, and a summary of the formulas used in the computations is given. The expected values of the estimates are based on linear combinations of covariances. Also considered is the statistical variability. Ground surface roughnesses as shown in spectral charts taken at field sites are compared and are found to be in good agreement with visual observations. K.W.

N66-39000# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
A USEFUL APPROXIMATION TO THE NORMAL DISTRIBUTION FUNCTION, WITH APPLICATION TO SIMULATION
Irving W. Burr Jul. 1966 11 p refs Sponsored by GE Found. *Its* Mimeograph Ser. No. 82

A close approximation to the distribution function ϕ (u) is given in which the solution for u in terms of random number N is explicit and algebraic. It is therefore much faster than direct use of ϕ (u), it can generate many more random "normal" deviates per unit computer time, and it is much easier to program. Solutions and accuracy of the approximations are compared in tables. The application in computer simulation is briefly pointed out. K.W.

N66-39110# Joint Publications Research Service, Washington, D. C.

THE SEARCH ALGORITHM FOR OPTIMAL DISTRIBUTION OF CENTRALIZED RESOURCES

T. N. Pervozvanskaya and A. A. Pervozvanskiy *In its* Tech. Cybernetics, No. 3, 1966 28 Sep. 1966 p 21–26 refs (See N66-39108 24-10) CFSTI: $6.00

Computational systems for the solution of the problem of optimal distribution of centralized resources among links of a complex system are discussed. A problem in linear programming is formulated and reduced to the problem of game theory; the interative system for solving the problem is discussed. Computation is based on reduction of the initial problem to the problem of maximizing a piecewise–linear function inexplicably given in problem of game theory; the interative system for solving the problem is discussed. Computation is based on reduction of the initial problem to the problem of maximizing a piecewise–linear function inexplicably given in the space of the new variables. After reduction it turns out to be effective to use the method of possible directions. It is noted that the basic diagram of motion toward the optimum using the purchasing and selling the space of the new variables. R.LI.

N66-39111# Joint Publications Research Service, Washington, D. C.

OPTIMAL CONTROL OF RESERVES WITH RANDOM DELAY OF DELIVERIES

Yu. I. Ryzhikov *In its* Tech. Cybernetics, No. 3, 1966 28 Sep. 1966 p 27–42 refs (See N66-39108 24-10) CFSTI: $6.00

A method is proposed for calculating the expected expenses in the system of material–technical supply with random delay of deliveries based on an analogy with problems in the queueing theory. The contradiction of the laws of economics is resolved by using reserve control theory methods, the object of which is to find a rule (strategy) for replenishing reserves. Formulas are proposed for calculating the probabilities of the states of the system and the expected expenses. An algorithm is presented for minimization of the expenses and the condition of convergence. R.LI.

N66-39116# Joint Publications Research Service, Washington, D. C.

THE FLOW OF LOST DEMANDS IN CERTAIN QUEUEING SYSTEMS WITH LIMITATION

L. G. Afanas'yeva *In its* Tech. Cybernetics, No. 3, 1966 28 Sep. 1966 p 83–98 refs (See N66-39108 24-10) CFSTI: $6.00

Systems are investigated in which a demand with some determinant probability may turn out to be added to a queue. It is proved that for exponential servicing time and a semi-Markov input flow the flow of lost demands will also be semi-Markov. Some expressions are derived which offer the possibility of determining the characteristics of the flow of lost demands. The ergodic theorem for systems with exponential servicing time and a semi-Markov input flow is proved. Examples are presented. Author

N66-39123# Joint Publications Research Service, Washington, D. C.

A METHOD FOR CONVERSION OF THE FUNCTIONS OF MATHEMATICAL LOGIC

V. I. Strelets *In its* Tech. Cybernetics, No. 3, 1966 28 Sep. 1966 p 153–164 refs (See N66-39108 24-10) CFSTI: $6.00

Two methods are investigated for equivalent transformations of logical words and polynomials which permit simplification of the schematic realization of some class of logical functions. Author

N66-39457# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.

SIMULTANEOUS APPROXIMATION OF CERTAIN FUNCTIONS BY POLONOMIALS AND THEIR DERIVATIVES [OB ODNOVREMENNOY APPROKSIMATSII NEKOTORYKH FUNKSTIY POLINOMAMI I IKH PROIZVODNYMI]

Ye. Sh. Chatskaya Jun. 1966 11 p refs Transl. into ENGLISH from Dokl. Akad. Nauk Arm. SSR (Erevan), v. 41, no. 3, 1965 p 129–134 p 129–134 (ACIC-TC-1074; TT 66-62126; AD-637533) CFSTI: HC $1.00/MF $0.50

The extreme problems connected with simultaneous approximation of two functions are investigated. One of the functions is approximated by polynomials P sub n, and the second one by the derivatives of these polynomials or (in a wider sense) by polynomials NP sub n, where N is a certain linear operator. Of special interest is the characteristic properties of the extreme polynomials, problems of their uniqueness, and the determination of the connection between the approximate problems and some other problems that are reciprocal to them Author (TAB)

N66-39460# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PROGRESS IN MATHEMATICS

Shen Shah-yi 26 Mar. 1966 64 p refs Transl. into ENGLISH from Shu Hsueh Chin Chan (Communist China), v. 7, no. 1, 1964 p 1–38

(FTD-TT-65-348; TT-66-62104; AD-637431) CFSTI: HC $3.00/MF $0.75

Translation of Chinese research: basic problems of stationary channels. TAB

N66-39466# Center for Naval Analyses, Washington, D. C. Franklin Inst.

SOLUTION OF A NON-LINEAR ALLOCATION GAME BY PERTURBATION OF THE SIDE CONDITIONS

J. M. Danskin 9 Jun. 1966 29 p refs *Its* Res. Contrib.-23 (Contract Nonr-3732(00))

(AD-637550) CFSTI: HC $2.00/MF $0.50

A non-linear military allocation game is reduced by a device to a series of linear games, thus permitting easy solution and easy examination of the effect of perturbation of side conditions. An application to a practical problem of allocation in anti-submarine warfare is given. Author (TAB)

N66-39490# Research Analysis Corp., McLean, Va.

OPTIMAL BAYESIAN STRATIFIED SAMPLING BY NONLINEAR PROGRAMMING

Richard M. Soland Jun. 1966 14 p refs

(Contract DA-44-188-ARO-1)

(RAC-TP-221; AD-637593) CFSTI: HC $1.00/MF $0.50

The optimum allocation for stratified sampling is studied under the Bayesian assumption that prior information concerning the unknown stratum means is available. The prior information is assumed to be expressed in the form of a multivariate normal prior distribution for the unknown stratum means. There are r_i variates of interest in the ith stratum, so that each stratum mean

is a vector. The cost of sampling is the sum of the costs of sampling the various strata, and the cost of sampling the *i*th stratum is taken to be a constant c_i times the size of the sample taken from that stratum. Not all strata need be sampled. Several allocation problems are formulated and shown to be solvable by the standard algorithms of nonlinear programming. Author (TAB)

N66-39508# Lincoln Lab., Mass. Inst. of Tech., Lexington.
"MATCHED" POLYNOMIAL LEAST-SQUARES FITTING AND APPLICATION TO REAL-TIME BALLISTIC COEFFICIENT ESTIMATION
Harold Schneider 26 Jul. 1966 21 p refs *Its* Tech. Note 1966-34
(Contract AF-19(628)-5167; ARPA Order 498)
(ESD-TR-66-398; AD-637669) CFSTI: HC $1.00/MF $0.50

A form of least-squares spline function fitting is used to derive some general relationships that form the basis of a new real-time ballistic coefficient estimation technique Author (TAB)

N66-39525# Illinois Univ., Urbana.
ON HOMOGENEOUS DIAGONAL CONGRUENCES OF ODD DEGREE
Karl Kenneth Norton Aug. 1966 178 p refs
(Contract Nonr-1834(18))
(TR-16; AD-637773) CFSTI: HC $5.00/MF $1.00

A general theorem is proved on the number of solutions of a canonical congruence considered by Davenport and Lewis. Various lower bounds are obtained for $\Gamma^*(k)$ (usually in terms of the smallest prime $\equiv 1 \pmod k$). A few theorems are proved concerning the congruence $\Gamma^*(k) \equiv 1 \pmod k$. Finally, the exact value of $\Gamma^*(k)$ is obtained for $k=3, 5, 7, 9, 11$, and less precise numerical results are also given for odd k with $13 \leq k \leq 25$. Author

N66-39557# Brown Univ., Providence, R. I. Div. of Applied Mathematics.
SMOOTHING DERIVATIVES OF FUNCTIONS AND APPLICATIONS Technical Report No. 66-3
F. Wesley Wilson, Jr. Jun. 1966 36 p refs
(Contract DA-31-124-ARO(D)-270)
(AROD-5145-14; AD-637198) CFSTI: HC $2.00/MF $0.50

A technique for constructing a C^∞ Lyapunov function for a continuous vector field which has an asymptotically stable invariant set, is described. Proposed is a smoothing procedure which involves averaging the function by a convolution integral, thus preserving the desired derivative properties. To demonstrate the effectiveness of the proposed technique, it is shown that the derivative is preserved in the case where the function satisfies a Lipshitz condition. The applicability of the technique for studying the coverse Lyapunov problem, and for smoothing topological manifolds, is discussed. S.C.W.

N66-39566# Michigan Univ., Ann Arbor. Sensory Intelligence Lab.
NONSUPERVISED PATTERN RECOGNITION THROUGH THE DECOMPOSITION OF PROBABILITY FUNCTIONS
Donald F. Stanat (Ph.D. Thesis) Apr. 196ט 62 p refs
(Grant AF-AFOSR-367-65)
(AFOSR-66-1454; AD-637486) CFSTI: HC $3.00/MF $0.75

Two problems of parametric statistics are investigated with a view to their application to nonsupervised pattern recognition. Each of the problems can be described as follows: given a random sample drawn from a finite mixture of probability functions, where each element of the mixture is of a known parametric form, determine the unknown parameters of the mixture, f(X). The problem is treated in two parts. In the first part, it is assumed that the function f(X) is known and the decomposition of f(X) into its components is discussed. The second part deals with the estimation of f(X) on the basis of a random sample drawn according to it Author (TAB)

N66-39573# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
ALGORITHM FOR FINDING THE GENERAL FORMULA OF NON-NEGATIVE SOLUTIONS OF A SYSTEM OF LINEAR EQUATIONS
N. V. Chernikova 30 Jun. 1966 12 p ref Transl. into ENGLISH from Zh. Vychislitel'noi Mat. i Mat. Fiz. (Moscow), v. 4, no. 4, 1964 p 733–738
(Contract NOw-62-0604-c)
(TG-230-T485; TT-66-62067; AD-637309) CFSTI: HC $1.00/MF $0.50

The author shows how row operations on the matrix (I,A*) can lead to the determination of all non-negative solutions of $AX=O$. If A is a matrix of integers, the successive transformed matrices have integral entries. Systems of inequalities are also considered. The justification is based on E. Burger (ZAMM, 36, 135–139 (1956)). Remarks on the non-homogeneous system $Ax \geq B$ are included. Author (TAB)

N66-39636# Boeing Co., Seattle, Wash. Mathematics Research Lab.
ALGORITHMS FOR FRAMES AND LINEALITY SPACES OF CONES
Roger J. B. Wets and Christoph Witzgall (Natl. Bur. of Std.) Jun. 1966 29 p refs *Its* Mathematical Note 472
(D1-82-0544; AD-637141) CFSTI: HC $2.00/MF $0.50

The frame of a cone C is a minimal set of generators, and the lineality space L of C is the greatest linear subspace contained in C. Algorithms are described for determining the frame and the lineality space of a cone C(S) spanned by a finite set S. These algorithms can be used for determining the vertices, edges, and other faces of low dimension of the convex hull of a finite set H(S). All algorithms are based on the simplex method of linear programming. The problem of finding the lineality space can be successively reduced to problems in spaces of lower dimensions Author (TAB)

N66-39647# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
STOCHASTIC PROGRAMS WITH RECOURSE
David W. Walkup and Roger J.-B. Wets Jul. 1966 32 p refs *Its* Math. Note No. 474
(D1-82-0551; AD-637139) CFSTI: HC $2.00/MF $0.50

So far the study of stochastic programs with recourse has been limited to the case (called by G. Dantzig programming under uncertainty) when only the right-hand sides or resources of the problem are random. In this paper the authors extend the theory to the general case when essentially all the parameters involved are random. This generalization immediately raises the problem of attributing a precise meaning to the stochastic constraints. They examine a probability formulation (satisfying the constraints almost surely) and a possibility formulation (satisfying the constraints for all values of the random parameters in the support of their joint distribution) and show them equivalent under a rather weak but curious W-condition. Finally, they prove that without restriction the equivalent deterministic form of a stochastic program with recourse is a convex program for which we obtain some additional properties when some of the parameters of the original problem are constant. The applications of the theoretical results of this paper to certain classes of stochastic programs which have arisen from practical problems will be presented in a separate paper: Stochastic Programs with Recourse: Special Forms. Author (TAB)

N66-39673# Michigan State Univ., East Lansing. Dept. of Statistics and Probability.
APPROXIMATION TO BAYES RISK IN SEQUENCES OF NON-FINITE DECISION PROBLEMS Technical Report No. 10
Dennis Crippen Gilliland 12 Aug. 1966 63 p refs
(Contract Nonr-2587(02))
(RM-162; DC6-3; AD-637585) CFSTI: HC $3.00/MF $0.75

Consideration is given to a statistical decision problem in which the display of some dependencies is suppressed and the operator notation is used to reduce the complex mathematics involved. Next, a sequential compound estimation is presented for squared error loss, some discrete exponential families, and a family of normal distributions. Finally, the Bayes response to the empirical distribution of opponents past in sequential decision problems is considered. A direct generalization to the countable M case is given, and a theorem is proved with applications in the uncountable M case. S.P.

N66-39721*# Innsbruck Univ. (Austria). Inst. of Theoretical Physics.
ON THE SOLUTION OF THE DIFFERENTIAL EQUATIONS RESULTING FROM THE SEPARATION OF LAPLACE EQUATION IN VARIOUS COORDINATE SYSTEMS, BY MEANS OF LIE SERIES Scientific Report No. 9
F. Cap and A. Schett Aug. 1966 27 p refs
(Grant NGR-52-046-001)
(NASA-CR-78948) CFSTI: HC $2.00/MF $0.50 CSCL 12A

The R and S separability of Laplace and Helmholtz equations are tabulated in various coordinate systems. The list is restricted to 11 coordinate systems in which the Helmholtz equation is separable and the most important coordinate systems with regard to technical problems in which the Laplace equation is R-separable. Types of differential equations resulting from a separation of the Laplace equation are discussed. Consideration is also given to Legendre polynomials for the case in which the differential equation appears in the separation equations of spherical polar coordinates, after splitting up the singularities. L.E.W.

N66-39734# Syracuse Univ., N. Y.
PERIODIC SYSTEMS OF THE PERTURBATION TYPE: SMALL PARAMETER BOUNDS Interim Technical Report, 29 Oct. 1964–29 Oct. 1965
Stephen George Dick Griffiss AFB, N. Y., RADC, Aug. 1966 191 p refs
(Contract AF 30(602)-3538)
(RADC-TR-66-322; AD-637772) CFSTI: HC $1.00

Bounds on the small parameter of systems of the perturbation type are developed to insure existence of periodic solutions. Solutions sought are in k, the space of functions which are periodic in time, t, of period T and are Lebesque square integrable over a period. The procedure follows the general framework of the Hale-Cesari technique. A projection operator, suitably defined on k, is used to decompose the problem into two parts, an associated equation and a bifurcation equation. Iteration procedures are developed for both the associated equation and the bifurcation equation. The tools of functional analysis and, in particular, the Contraction Mapping Fixed Point Theorem are used to establish bounds on the small parameter, beta, to insure the convergence of each of the iteration procedures. The smaller of the two bounds obtained is recognized as the value which insures solution to the overall system Author (TAB)

N66-39746# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.
AN APPROXIMATION PROCESS RELATED TO LEGENDRE POLYNOMIALS [OB ODNOM APPROKSIMATSIONNOM PROTSESSE, SVYAZÁNNOM S POLINOMAMI LEZHANDRA]
I. K. Daugavet Jul. 1966 17 p refs Transl. into ENGLISH from Metody Vychisleniy (Leningrad), Issue 2, 1963 p 29–38
(ACIC-TC-1075; TT-66-62127; AD-637534) CFSTI: HC $1.00/MF $0.50

A mathematical series obtained through integration of a Fourier series by the derivative of a continuous function differentiated with respect to a Legendre polynomial, is shown to converge toward the function with approximately the same speed. L.S.

N66-39770# Utah Univ., Salt Lake City.
INVESTIGATION OF THE ASSUMPTIONS OF THE PROBABILISTIC THEORY OF ROUND-OFF ERRORS IN NUMERICAL INTEGRATION OF DIFFERENTIAL EQUATIONS Final Report, 1 Jul. 1963–31 Mar. 1966
Kurt W. Endl Jun. 1966 32 p refs
(Contract DA-31-124-ARO(D)-132)
(AROD-4210-1; AD-637201) CFSTI: HC $2.00/MF $0.50

A study has been made of the assumption of the probabilistic theory of round-off errors in numerical integration of differential equations. To test the valadity of this theory experiments were performed to test the very assumption of this model, namely the randomness of the local round-off error. In conclusion, the most critical factor, deciding on randomness of the local round-off error, is the proportion of step-length and accuracy Author (TAB)

N66-39774# Stanford Research Inst., Menlo Park, Calif.
GENERALIZED DIRECT DECOMPOSITIONS OF BASIC UNARY ALGEBRAS Scientific Report No. 6
Michael Yoeli 15 Apr. 1966 14 p refs
(Contract AF 19(628)-5092)
(AFCRL-66-451; AD-637709) CFSTI: HC $1.00/MF $0.50

A representation of a unary algebra (complete transition graph) as homomorphic image of a subdirect product is called a generalized direct decomposition. A preceding report (AD-630 304) derived necessary and sufficient conditions for a unary algebra to be indecomposable, i.e. to have only trivial generalized direct decompositions. This report describes computational techniques for obtaining all generalized direct decompositions of a given connected unary algebra with cycle length 1 (basic algebra) into indecomposable factors. The canonical expressions for transition graphs introduced earlier (AD-463 300) play an important role in this connection Author (TAB)

N66-39780# Johns Hopkins Univ., Baltimore, Md. Dept. of Statistics.
LINEAR LEAST SQUARES REGRESSION
Geoffrey S. Watson Jul. 1966 48 p refs Presented at Spring IMS Meeting, Upton, N. Y., Apr. 1966
(Contract Nonr-4010(09))
(TR-57; AD-637245) CFSTI: HC $2.00/MF $0.50

The paper gives a self-contained account of linear least squares regression when the errors have an arbitrary error covariance matrix. The finite sample size case is treated algebraically by methods which are entirely analogous to those used for the asymptotic study of the same problem by spectral analysis when the errors are generated by a covariance stationary process. The algebraic methods and results are of interest in themselves and may also be useful as an introduction to the difficult analysis involved in the asymptotic treatment Author (TAB)

N66-39802# RAND Corp., Santa Monica, Calif.
HITTING TIMES AND POTENTIALS FOR RECURRENT STABLE PROCESSES
Sidney C. Port Aug. 1966 42 p refs
(Contract AF 49(638)-1700; Proj. RAND)
(RM-5104-PR; AD-637463) CFSTI: HC $2.00/MF $0.50

The potential theory for the recurrent stable processes is developed and used to investigate hitting time and hitting place for compact sets Author (TAB)

N66-39804# Cornell Univ., Ithaca, N. Y. Dept. of Industrial Engineering and Operations Research.
A COMPARISON OF THE PERFORMANCE CHARACTERISTICS OF TWO SEQUENTIAL PROCEDURES FOR RANKING MEANS OF NORMAL POPULATIONS

John S. Ramberg (M.S. Thesis) May 1966 124 p refs
(Contract NONR-401(53); Grant NSF G-22585)
(TR-4; AD-634342) CFSTI: HC $4.00/MF $0.75

This paper reports on the results of a Monte Carlo study of the performance characteristics of three statistical procedures for selecting the normal population with the largest population mean, when the population variances are known and equal. The procedures are the Bechhofer-Kiefer-Sobel (open-ended) sequential procedure, the Paulson (closed) sequential procedure, and the Bechhofer single-stage procedure. Particular emphasis is given to the expected number of stages, and the expected total number of observations required to terminate experimentation for the sequential procedures. In addition to comparisons between procedures, the performance characteristics of the Paulson procedure (actually a family of procedures) are studied as a function of the parameter defining the family. Author (TAB)

N66-39820# Atomic Energy Establishment, Winfrith (England). Control and Instrumentation Div.
APPLICATION OF GROUP THEORY TO LINEAR DYNAMICAL SYSTEMS
A. G. J. Mac Farlane (London Univ.) and D. Mitra Mar. 1966 43 p refs
(AEEW-M-636)

A transformation of the state variables of a linear dynamical system generates another linear system which may have some properties in common with the original system; certain invariant properties define a subgroup of transformations within the linear group. Using the general functional matrix, an investigation has been made of those subgroups which leave invariant a functional of a general algebraic form of the system state variables. The general concepts of group theory have been reviewed and an example given of the application of a finite transformation to a linear electrical network. The theory required to apply the concepts of continuous groups and infinitesimal transformation to linear dynamical systems is briefly reviewed. This theory is then applied to the linear electrical network. It is shown that for a simple class of networks, a set of differential equations may be obtained which govern the continuous generation of networks having an invariant property while retaining the same structure. Author

N66-39875# Brazil Univ., Rio de Janeiro. Inst. of Pure and Applied Mathematics.
ELEMENTS OF APPROXIMATION THEORY
Leopoldo Nachbin (Rochester Univ.) 1965 129 p refs Supported in part by NSF *Its* Nota de Math. No. 33
CFSTI: HC $4.00/MF $1.00

Lecture notes on a course in approximation theory are presented, including such classical material as the Hahn-Banach theory for vector subspaces, convex subsets, and convex cones; the Kakutani-Stone theorem for lattices; the Weierstrass-Stone theorem for algebras; the Dieudonne theorem for tensor products; and the Choquet-Deny theorem for convex, or convex conic, sup-lattices. The Weierstrass-Stone theorem for modules is considered, and recent work on the weighted approximation problem for modules is discussed. The classical Bernstein approximation problem on R^n was extended, in the same sense that the Weierstrass-Stone theorem generalized the classical Weierstrass theorem on R^n. After proving some general sufficient conditions for localizability, they were used to establish quasi-static, analytic, and bounded criteria. L.E.W.

N66-39902*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
AN ENGINEERING EXPOSE OF NUMERICAL INTEGRATION OF ORDINARY DIFFERENTIAL EQUATIONS
John L. Engvall Washington, NASA, Nov. 1966 35 p refs
(NASA-TN-D-3696) CFSTI: HC $2.00/MF $0.50 CSCL 12A

An error analyses for numerically integrating first order ordinary differential equations is presented. Roundoff, truncation, mathematical instability, and numerical instability errors are the four basic errors considered. Emphasis is placed upon the catastrophic effects of numerical instability errors. Several examples of numerical and mathematical instability errors are contained. Author

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N66-39148# California Univ., Davis.
INVESTIGATION OF ENERGY, MOMENTUM AND MASS TRANSFER NEAR THE GROUND Final Report, 1965
F. A. Brooks, W. O. Pruitt et al Jun. 1966 284 p refs
(Contract DA-AMC-28-043-65-G12; Grant NIH FR-0009)
(AD-635588) CFSTI: HC $6.00/MF $1.50

Fundamental measurements of the actual air-drag force on a mowed grass turf are documented, and measurements data are presented on moisture flux rates, and profiles of windspeed, temperature, and moisture. Details are also given on the measuring apparatus and techniques used, and on instrument accuracy and evaluation methods. Computer programming, and data storage and reduction are presented. For individual titles see N66-39149–N66-39175.

N66-39149# California Univ., Davis.
REPORT OUTLINE AND MAIN ACCOMPLISHMENTS, 1963–1965, CHAPTER I
F. A. Brooks and W. O. Pruitt *In its* Invest. of Energy, Momentum and Mass Transfer Near The Ground Jun. 1966 p 1–4 refs (See N66-39148 24-20) CFSTI: HC $6.00/MF $1.50

Abstracted data are presented from selected studies within the entire research project. Major accomplishments are briefly mentioned, significant results are pointed out, and the main emphasis of each individual project is indicated. A.G.O.

N66-39150# California Univ., Davis.
OBSERVED FOUR-COMPONENT HOURLY ENERGY BALANCES, CHAPTER II
F. A. Brooks and W. B. Goddard *In its* Invest. of Energy, Momentum and Mass Transfer Near The Ground Jun. 1966 p 5–24 refs (See N66-39148 24-20) CFSTI: HC $6.00/MF $1.50

Energy, momentum, and moisture flux rates are presented in tabular form, and diurnal curves for nearly cloudless sky conditions showing hourly magnitudes of 4 energy flux rates observed in major field tests are given. It is noted that these flux measurements furnish fundamental data for many kinds of studies of energy and mass transfers outdoors over a standardized irrigated turf. Consideration is also given to basic formulas for flux/gradient relationships, methods for obtaining meaningful mean magnitudes, and the complex relationships between irregular profiles and nearly steady flux rates. A.G.O.

N66-39151# California Univ., Davis.
POLYNOMIAL EXPRESSIONS FOR PROFILES OF AIRSPEED, TEMPERATURE AND MOISTURE OVER AN IRRIGATED TURF, CHAPTER III
F. A. Brooks, F. F. Mulholland, and L. A. Smith *In its* Invest. of Energy, Momentum and Mass Transfer Near The Ground Jun. 1966 p 25–36 refs (See N66-39148 24-20) CFSTI: HC $6.00/MF $1.50

A revised polynomial formula is described which consists of log-law + power-law terms. Machine computed tables of airspeed, temperature, and moisture profiles are given including data on the reversal in gradients near the times of neutral stability. However, it is concluded that no simple profile shape should be expected outdoors without firm restriction to predominantly eddy-friction flow. Consistent interpretations of daytime eddy transfers are possible, but a wide range in data must be thoroughly analyzed for self-consistency in flux/gradient relationships before dependable formulas covering diurnal variations of interdependent coefficients can be established for an outdoor surface covered with growing plants. A.G.O.

N66-39152# California Univ., Davis.
TESTS OF AERODYNAMIC, ENERGY BALANCE AND OTHER EVAPORATION EQUATIONS OVER A GRASS SURFACE, CHAPTER IV
W. O. Pruitt and F. J. Lourence *In its* Invest. of Energy, Momentum and Mass Transfer Near The Ground Jun. 1966 p 37–63 refs (See N66-39148 24-20) CFSTI: HC $6.00/MF $1.50

Measured evapotranspiration rates for perennial ryegrass were compared with calculated vapor flux rates using aerodynamic, energy balance, and combination approaches. Consideration was given to the aerodynamic expression proposed by Thornwaite and Holzman, a method proposed by Deacon and Swinbank, a modified Dalton expression, the Bowen ratio approach, and the combination aerodynamic-energy balance equation suggested by McIlroy. It is pointed out that from overall considerations the Bowen ratio approach provided highly satisfactory evapotranspiration estimates, for the wide range of stability conditions under which it was tested. A.G.O.

N66-39153# California Univ., Davis.
THE ENVIRONMENT OF THE GRASS CANOPY, CHAPTER V
S. W. Burrage *In its* Invest. of Energy, Momentum and Mass Transfer Near The Ground Jun. 1966 p 65–75 refs (See N66-39148 24-20) CFSTI: HC $6.00/MF $1.50

Results of air temperature and humidity measurements within and just above the canopy are reported in a study to determine the structure of the grass canopy, the temperature changes taking place, and the radiation pattern within the canopy. Fine-wire thermocouple measurements of soil surface, mulch surface, and leaf temperature at various heights are given along with leaf area index and net radiation data in order to see how these were affected by structure, and to determine how this ultimately influenced the environmental conditions in the crop. Because the results indicate that the structure of the crop controlled the environmental conditions at the various levels within the canopy, it is noted that great care must be taken in the management of the crop to obtain reproducible environmental conditions within the plant canopy and a consistent source for measurements above the canopy. A.G.O.

N66-39157# California Univ., Davis.
INTERPRETATION OF SHEAR STRESS MEASUREMENTS AT THE MICROMETEOROLOGICAL SITE AT THE UNIVERSITY OF CALIFORNIA, DAVIS, CHAPTER VIII
H. F. Poppendiek and W. A. Morton *In its* Invest. of Energy, Momentum and Mass Transfer Near The Ground Jun. 1966 p 99–109 refs (See N66-39148 24-20) CFSTI: HC $6.00/MF $1.50

An analysis is presented of shear stress measurements of selected major micrometeorological field tests obtained with the use of a 20-foot shear lysimeter. Thirteen sets of simultaneous data involving shear stress, wind velocity, wind direction, and temperature were used in these studies. Emphasis was placed on the relation of drag coefficients and eddy diffusivities to wind velocities and simple atmospheric stability parameters. In addition, specific topics such as the effect of the number of readings per unit time used to obtain a shear stress average and the effect of changes in wind direction on the shear stress were investigated. C.T.C.

N66-39158# California Univ., Davis.
MOMENTUM EXCHANGE IN THE ATMOSPHERE NEAR NEUTRAL CONDITIONS, CHAPTER IX
W. B. Goddard *In its* Invest. of Energy, Momentum and Mass Transfer Near The Ground Jun. 1966 p 111–114 refs (See N66-39148 24-20) CFSTI: HC $6.00/MF $1.50

A micrometeorological investigation is presented of the shear stress measurements necessary in relating momentum flux to wind velocity gradients. A table is given of the relationship between the momentum function and z'/L, where z' is the zero plane corrected height and L is the scale of thermal stability. It is noted that a broader range of stabilities is needed before any functional relationship can be defined, but that near neutral the values obtained were close to one. C.T.C.

N66-39159# California Univ., Davis.
SENSIBLE HEAT MEASUREMENT WITH THE C.S.I.R.O. EVAPOTRON, CHAPTER X
W. B. Goddard *In its* Invest. of Energy, Momentum and Mass Transfer Near The Ground Jun. 1966 p 115–122 refs (See N66-39148 24-20) CFSTI: HC $6.00/MF $1.50

Procedures and results are presented of sensible heat mode and moisture flux mode micrometeorology field tests conducted with the use of an evapotron. The evapotron determines the moisture or sensible heat flux by measuring directly the specific moisture or heat content of the air and its vertical movement and automatically integrating them over the run period. The use of water by cotton was determined under field conditions using moisture measurements by eddy-flux and energy balance methods. A comparison was made between the neutron method and the direct moisture flux values obtained by the evapotron on both skip row and solid planted cottons. C.T.C.

N66-39160# California Univ., Davis.
USE OF FOURIER HARMONIC ANALYSIS OF OBSERVED TEMPERATURE CYCLES TO SUPPLEMENT DIURNAL MEASUREMENTS OF SOIL HEAT FLUX, CHAPTER XI
F. A. Brooks, M. El Nahal, and A. M. Brown *In its* Invest. of Energy, Momentum and Mass Transfer Near The Ground Jun. 1966 p 123–134 refs (See N66-39148 24-20) CFSTI: HC $6.00/MF $1.50

Consideration is given to such topics as experimental errors, the calculation of thermal properties of loam, and the conduction of heat in the ground in an analysis of observed temperature cycles to supplement diurnal measurements of soil heat flux. Also considered are temperature and heat cycles at different depths, comparisons of actual and calculated heat flux, and an expression for cyclic heat flux at the soil surface based on temperature measurements at 10-cm depths. Conclusions are that perfect determinations of heat flux cycles from temperature cycles is impossible when thermal properties vary with depth, but good approximation can be obtained. Allowance should be made for moisture lost by evaporation from the soil itself. C.T.C.

N66-39161# California Univ., Davis.
MEASUREMENT OF GRASS TEMPERATURES WITH THERMOCOUPLES AND INFRARED TECHNIQUES, CHAPTER XII
F. J. Lourence, W. O. Pruitt, and S. W. Burrage *In its* Invest. of Energy, Momentum and Mass Transfer Near The Ground Jun. 1966 p 135–141 refs (See N66-39148 24-20) CFSTI: HC $6.00/MF $1.50

Results are presented of comparisons between measurements using an infrared thermometer and temperature data obtained

with 40 gage thermocouples clipped onto leaves of a crop of Alta fescue. The results show that agreement between the surface temperature measurements was not entirely satisfactory. The major disagreement occurred during the daylight hours under maximum radiation conditions with the thermocouples indicating the higher temperature. There is strong evidence that the leaf thermocouples are overestimating the surface temperature of the crop due to radiation errors. C.T.C.

N66-39162# California Univ., Davis.
COMPARISON OF RADIATION EXCHANGE COMPONENTS, CHAPTER XIII
D. L. Morgan and F. J. Lourence *In its* Invest. of Energy, Momentum and Mass Transfer Near The Ground Jun. 1966 p 143–152 refs (See N66-39148 24-20) CFSTI: HC $6.00/MF $1.50

An examination is presented of the individual radiation components involved in net radiation exchange near the earth's surface. The data were obtained with a hemispheric radiometer, net exchange radiometers, whole hemisphere solar radiation radiometers, and a normal incidence solar radiation radiometer. The components considered include (1) shortwave consisting of the normal incident solar energy from the sun attenuated by the atmosphere (S), the diffuse sky light (s), and the combination of (S) and (s) reflected by the surface, and (2) longwave consisting of the thermal radiation from the earth, the radiation returned from the atmosphere, and the atmospheric radiation reflected from the earth's surface. Conclusions are that the albedo of fescue grass not only changes with solar altitude but also with the condition of the grass. During the day, values of measured net radiation generally agreed withing 10% of values calculated from the radiation components; at night larger deviations appeared. Values of measured total incoming radiation generally agreed within 5% of values calculated from radiation components. C.T.C.

N66-39164# California Univ., Davis.
SOME COMPARISONS OF THE DAVIS FIELD EXPERIMENTS, CHAPTER XV
M. G. Wurtele *In its* Invest. of Energy, Momentum and Mass Transfer Near The Ground Jun. 1966 p 159–160 (See N66-39148 24-20) CFSTI: HC $6.00/MF $1.50

Some remarks are presented of recently obtained mean temperature gradient data for extreme Richardson numbers. An experimental apparatus is described and preliminary results are given from which conflicting data were obtained. A brief discussion is included of the correspondence between field data and theory relative to the advection problem. An extreme idealized case is mentioned involving a discontinuous transition from an infinite half plane characterized by one uniform roughness to a half-plane with a different uniform roughness. C.T.C.

N66-39165# California Univ., Davis.
SOME CONSIDERATIONS IN THE TREATMENT OF PROFILE SLOPES, CHAPTER XVI
W. P. Berggren *In its* Invest. of Energy, Momentum and Mass Transfer Near The Ground Jun. 1966 p 161–164 (See N66-39148 24-20) CFSTI: HC $6.00/MF $1.50

Some approaches in correlating the height variations of the fluxes of momentum, heat, and water vapor with the mean profiles of the corresponding potentials (velocity, temperature, and absolute humidity) are considered. Areas discussed include fitting of profiles for various stability conditions, hazards of autocorrelations, nonlinear and dually-linear profiles, classification of profiles by stability, variation of shear stress with height, the gradients as independent entities susceptible to independent measurement, validity of relationships between time averages of fluctuating quantities, and proposed extensions of field measurements. C.T.C.

N66-39166# National Inst. for Agricultural Science, Tokyo (Japan). Div. of Meteorology.
MEASUREMENT OF TURBULENT TRANSFER OF WATER VAPOR
Eiichi Inoue *In* Calif. Univ. Invest. of Energy, Momentum and Mass Transfer Near the Ground Jun. 1966 p 165–169 refs (See N66-39148 24-20) CFSTI: HC $6.00/MF $1.50

Eddy-flux methods of measuring eddy transfer rates are briefly discussed, and eddy-scale formulas based on the constant distribution of eddy sizes are presented. The concept of stability length is noted, including a physical interpretation of stability length and some practical applications of this concept. It is concluded that the usefulness of the stability length concept has been demonstrated, and that a reconsideration of the concept from the purely physical viewpoint may interest more workers on micrometeorology in this length. A.G.O.

N66-39167# California Univ., Davis.
METEOROLOGICAL CONDITIONS DURING MAJOR RUNS, APPENDIX A
D. L. Morgan and N. S. Benes *In its* Invest. of Energy, Momentum and Mass Transfer Near The Ground Jun. 1966 p 171–203 (See N66-39148 24-20) CFSTI: HC $6.00/MF $1.50

Data tables are presented in order to provide a sketch of the gross meteorological framework, in which to view the micrometeorological data collected at the Davis Field Site in California. This data is organized by scale of coverage converging from synoptic weather data to data gathered in the immediate vicinity of the field site. Three basic weather regimes are described in detail and are identified for each major run. These regimes are closely related to the direction of the channeled air movement which comes from northerly, southeasterly, and southwesterly directions. A.G.O.

N66-39171# California Univ., Davis.
FOURIER HARMONIC ANALYSES FOR SOIL HEAT CONDUCTION, APPENDIX E
F. A. Brooks *In its* Invest. of Energy, Momentum and Mass Transfer Near The Ground Jun. 1966 p 229–238 refs (See N66-39148 24-20) CFSTI: HC $6.00/MF $1.50

Formulas supplementing a Fourier harmonic analysis of observed temperature cycles used in diurnal measurements of soil heat flux are presented in considerable detail. The usual mathematical development is adhered to, with emphasis placed on the sinusoidal time waves of heat flux at relatively shallow depths. Other areas considered include temperature and heat cycles at different depths and in situ determinations of thermal diffusivity. C.T.C.

N66-39425# White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
ATHENA FLIGHT NUMBER 046 (23 JUNE 1966) Meteorological Data Report
Len E. Carter Jul. 1966 44 p refs
(DR-47; AD-486109)

Meteorological data gathered for the launching of Athena Flight Number 046, Vehicle #D-034, are presented. The data are presented in tabular form. Author

N66-39506# RAND Corp., Santa Monica, Calif.
ON THE COMPUTATION OF SATURATION VAPOR PRESSURE
F. W. Murray Aug. 1966 9 p refs
(Contract Nonr-4715(00)(X))
(P-3423; AD-637612) CFSTI: HC $1.00/MF $0.50

Some problems involved in the computation of saturation vapor pressure of water for meteorological applications are discussed

Two formulations for saturation vapor pressure in the pure phase over a plane surface of water or ice are considered; namely, the Gpff-Gratch formulation, which is the internationally accepted standard, and the Tetens formulation, which is widely used because of its simplicity. It is concluded that the Tetens formulation gives results sufficiently close to those of the Goff-Gratch formulation for most meteorological applications Author (TAB)

N66-39507# Travelers Research Center, Inc., Hartford, Conn.
LAYER OF MAXIMUM WIND ANALYSIS TECHNIQUE Final Report, 1 Oct. 1965–15 Jul. 1966
David B. Spiegler Bedford, Mass., AFSC, Electron. Systems Div., Aug. 1966 79 p refs *Its* Publ.-7479-230
(Contract AF 19(628)-4924)
(ESD-TR-66-344; AF 19(628)-4924) CFSTI: HC $3.00/MF $0.75

An objective layer of maximum wind (LRMW) analysis technique is described and evaluated. The evaluation indicates that the technique represents a significant improvement over the previously developed level of maximum wind (LMW) analysis technique (Spiegler, D. B., and J. T. Ball, et al., 1965: Techniques for objective hemispheric analysis and prediction of the jet stream (AD-622 711)). A categorization procedure for wind profiles that results in nine jet stream categories is designed and used for the derivation of regression equations that supply the initial-guess fields for each of five LRMW parameters. The stratification of the profiles into nine categories is a refinement of the previous seven categories developed for the LMW analysis technique. The initial-guess LRMW equations are stable in tests with independent data and are capable of specifying, very well, the general characteristics of the LRMW profile. They also provide realistic values for the LRMW parameters over no-data areas that are consistent with the entire analysis area. The analysis technique locates jet cores between grid points and generates observations along these cores by using models of horizontal jet profiles. Thickness of the LRMW as one of the analysis fields in conjunction with the windspeed maximum, mean height of the LRMW, and vector shears below and above the LRMW enable the generation of a three-dimensional picture of the wind field in the vicinity of the jet stream. Over the data areas, where a comparison between objective and subjective analyses can be made, the objective LRMW analyses compare favorably with the subjective analyses Author (TAB)

N66-39666# Litton Systems, Inc., Minneapolis, Minn. Applied Science Div.
AIR-EARTH CURRENTS MEASURED WITH RADIOSONDES Final Report
Lothar H. Ruhnke 15 Jun. 1966 27 p refs
(Contracts DA-28-043-AMC-02216(E); DA-28-043-AMC-00074(E))
(Rept.-2992; AD-637314) CFSTI: HC $2.00/MF $0.50

Measurements of air-earth current density were made over a period of six months over Minnesota. Instrumentation consisted of balloon-borne radiosonde-electrometer packages with long wire antennas. The balloons were set to float at about 21 km altitude and were tracked until the signal faded out. The average current density of all 30 flights independent of local time was found to be 1.2 × 10 to the −12th power A/sq. m. The standard deviations of the fluctuations in the current density were computed. In general, the deviation was about 50 from ground level up to the end of the exchange layer, about 5 up to the tropopause, and about 1 above that. This shows that local disturbances do not allow measurements of total current density free of local influences below the tropopause and that measurements in the stratosphere can be used to study global current flows Author (TAB)

N66-39824# Comissao Nacional de Atividades Espaciais, São José dos Campos (Brazil). Laboratorio de Fisica Espacial.
METEOROLOGICAL SOUNDING ROCKET PROGRAM AT NATAL
J. A. M. Salgado, Ulysses Belculfine, Moacyr Del Tepesco, and F. de Mendonca Sep. 1966 58 p Presented at Exptl. Inter-Am. Meteorol. Rocket Network Executive Comm. Meeting, Ascochinga, Argentina, Sep. 1966
(LAFE-47) CFSTI: HC $3.00/MF $0.50

Data are tabulated for a series of meteorological rocket launchings. The successes and failures and also schedule modifications are discussed. In addition to ground instrumentation and data package exchange information, extensive meteorological data are tabulated. A preliminary analysis of temperature and winds is included. S.P.

N66-39961# White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
AEROBEE NASA 4.159 GG (15 JUL. 1966) Meteorological Data Report
Marjorie Mc Lardie Hoidale Aug. 1966 28 p refs
(DR-56; AD-486934)

Meteorological data gathered for the launching of Aerobee NASA 4.159 GG are presented for the National Aeronautics and Space Administration and for ballistic studies. The data appear, along with calculated ballistic data, in tabular form. Author (TAB)

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N66-38866*# Northrop Space Labs., Huntsville, Ala.
AN ANALYTICAL APPROACH TO SOLUTION OF TWO-POINT BOUNDARY CONDITION PROBLEMS IN OPTIMAL GUIDANCE Summary Report, May 1965–Apr. 1966
C. A. Gilchrist, L. Morrow, J. W. Newkirk, and M. L. Thompson Jun. 1966 302 p refs *Its* Res. and Analysis Sect. Tech. Mem. no. 189
(Contract NASw-1165)
(NASA-CR-78671; TM-292-6-038) CFSTI: HC $7.00/MF $1.75 CSCL 17G

Analytical approaches to path-adaptive guidance functions are investigated, with emphasis focused on optimal guidance functions and optimal ascent to circular orbit. A general approach is used, and solutions are sought which are free of approximations and restrictions. The equations used to solve the problems related to steering function and time-to-cutoff function are derived, and error analyses are presented. Term elimination and simplification of the equations are considered, along with methods of combining steering angle and time-to-cutoff expressions. The use of Fortran-compiled programs on the IBM 7094 is also described. Findings indicate that this formal, analytical approach to certain types of two-point boundary condition problems is feasible, and that the results obtained are in close agreement with numerical solutions obtained from trial and error methods. Correlation between nominal trajectories and those predicted by the analytical solution was demonstrated for a variety of circular orbit missions. M.G.J.

N66-38868*# TRW Systems, Redondo Beach, Calif.
BODY-FIXED, THREE-AXIS REFERENCE SYSTEM STUDY Phase I Final Report
D. D. Otten 2 May 1966 332 p refs
(Contract NAS8-20209)
(NASA-CR-78669; TRW-4499-6007-RO-000) CFSTI: HC $7.00/MF $1.75 CSCL 17G

Studies were conducted to determine the feasibility of using an analytic platform system on a Saturn boost mission. Three single-axis platforms, and three pendulous integrating gyroscope accelerometers were considered. The selected configuration is described, and the system error model and performance is presented. Inertial instruments and angular encoders were investigated, and attitude-reference and navigation equations for performing the analytic reference were derived. Computer requirements were determined, and studies were performed to determine the timing and memory requirements for computer mechanizations. Details are also given on flight simulations, and alignment studies. It was concluded that the results demonstrate the feasibility of using a strapped-down inertial reference assembly and an associated strapped-down digital computer to replace the gimbaled inertial measurement unit for guidance of the Saturn booster. M.G.J.

N66-39389*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
CONFERENCE ON GUIDANCE THEORY AND TRAJECTORY ANALYSIS
[1965] 108 p Conf. held in Cambridge, Mass., 17 Nov. 1965 (NASA-TM-X-57905) CFSTI: HC $4.00/MF $0.75 CSCL 17G

CONTENTS:
1. RESEARCH GOALS AND AN INTEGRATED APPROACH R. F. Hoelker 12 p (See N66-39390 24-21)
2. RESEARCH PROGRAM FOR CELESTIAL MECHANICS M. H. Payne 13 p (See N66-39391 24-21)
3. RESEARCH IN ASTRODYNAMICS AND COMPUTER EXPLOITATION N. J. Braud 12 p (See N66-39392 24-21)
4. RESEARCH IN OPTIMIZATION AND GUIDANCE THEORY D. H. Schmieder 8 p (See N66-39393 24-21)

N66-39390*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
RESEARCH GOALS AND AN INTEGRATED APPROACH
Rudolf F. Hoelker *In its* Conf. on Guidance Theory and Trajectory Analysis [1965] 12 p (See N66-39389 24-21) CFSTI: HC $4.00/MF $0.75

Technical areas of interest are defined and development trends that show the most promise for future decades of space flight are developed. Emphasis is placed on fast and efficient onboard computational methods to optimize flight profiles and real time generation of steering commands. Essential contributions for guidance systems are expected from the development of more efficient and powerful guidance modes; advanced guidance modes for trajectories will consider celestial mechanics, astrodynamics, and optimization theory, as well as numerical high speed automatic computer output. G.G.

N66-39391*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
RESEARCH PROGRAM FOR CELESTIAL MECHANICS
Mary H. Payne *In its* Conf. on Guidance Theory and Trajectory Analysis 17 Nov. 1965 13 p (See N66-39389 24-21) CFSTI: HC $4.00/MF $0.75

Areas in which research on celestial mechanics are indicated are outlined, and the existing methods are examined for their possible extension and application to represent free flight trajectories between two or more celestial bodies. The behavior of single trajectories as well as the large scale behavior of classes of solutions, and the search of additional integrals of motion are among the main problems of interest. G.G.

N66-39392*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
RESEARCH IN ASTRODYNAMICS AND COMPUTER EXPLOITATION
Nolan J. Braud *In its* Conf. on Guidance Theory and Trajectory Analysis 17 Nov. 1965 12 p (See N66-39389 24-21) CFSTI: HC $4.00/MF $0.75

Analytical research in both mathematical and computational methods for guidance theory and mechanization procedures centers on data management and sensible representation of results which are of multivariant functional character. World-wide cooperation in numerical studies is projected for global solutions of two-point boundary problems in trajectory guidance. G.G.

N66-39393# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
RESEARCH IN OPTIMIZATION AND GUIDANCE THEORY
David H. Schmeider *In its* Conf. on Guidance Theory and Trajectory Analysis 17 Nov. 1965 8 p (See N66-39389 24-21) CFSTI: HC $4.00/MF $0.75

Trajectory optimization problems for powered flight are being analyzed by the classical calculus of variations, the modern calculus of variations, and numerical methods. Considered are such problems as non-linear constraints on state and control variables; a simultaneous solution of a split boundary value problem in the sense of the Denbow theory for application to interplanetary profiles; and qualitative information on the structure of classes of solutions, their stability behavior, and possible information acquisition of global character. A method of perturbation analysis, developed for classical celestial mechanics, will be utilized for low thrust trajectory optimization. G.G.

N66-39538*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NAVIGATION ACCURACY FOR INFRARED EQUIPPED APOLLO AIRCRAFT FOR REENTRY TRACKING
F. Kalil Washington, NASA, Nov. 1966 35 p refs (NASA-TN-D-3703) CFSTI: HC $2.00/MF $0.50 CSCL 17G

The navigational accuracy requirements were analyzed for an Apollo reentry aircraft equipped with an infrared acquisition and tracking system (IRATS) for monitoring the reentry of the Apollo Command Module. The navigational accuracy requirements are functionally dependent on: detector size, number of detectors, dwell time, scan rate, search field, optical system focal length and aperture size, detection probability, false alarm rates, and thermal characteristics of the reentering spacecraft. Thus, it was believed necessary to investigate these parameters in order to make the necessary trade-offs and come up with some realistic requirements. This was done by analyzing some conceptual designs which could fulfill the requirements set forth regarding acquisition time, detection range, probability of detection, and pointing accuracy. It was concluded that the navigational accuracy of the IRATS equipped aircraft should be about 2 n.mi. (1σ) on each the latitude and longitude, assuming a negligible altitude error. Author

N66-39771# Harvard Univ., Cambridge, Mass. Cruft Lab.
EXPLICIT GUIDANCE LAW FOR MINIMUM FUEL HORIZONTAL TRANSLATION WITH BOUNDED CONTROL
Jason L. Speyer and Arthur E. Bryson, Jr. May 1966 23 p ref
(Contract Nonr-1866(16))
(TR-500; AD-637250) CFSTI: HC $1.00/MF $0.50

An explicit guidance law was developed by Conrad (AIAA J. v3 1965) for minimum fuel horizontal translation of a rocket vehicle. This note demonstrates that Conrads guidance law can be expressed more compactly by use of dimensionless variables. It is shown that the control variable depends on only one dimensionless state variable instead of the original two state variables. Author (TAB)

N66-39842# Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands).
SHORT-RANGE, MEDIUM-RANGE AND LONG-RANGE RADIO-NAVIGATION
H. J. Bos, comp. May 1966 138 p refs In ENGLISH, DUTCH and GERMAN
(TDCK-44957) CFSTI: HC $4.00/MF $1.00

This bibliography contains a literature survey, comprising 238 abstracts of published papers and reports on the subject of radio navigation. The available material is presented chronologically in three chapters, for short-, medium-, and long-range applications respectively. An introduction and an author index are included. Author

N66-39907*# Auburn Research Foundation, Inc., Ala.
DIGITAL COMPENSATION OF THE THRUST VECTOR CONTROL SYSTEM
H. M. Summer 13 Nov. 1964 41 p refs
(Contract NAS8-11274)
(NASA-CR-79122) CFSTI: HC $2.00/MF $0.50 CSCL 17G

The pulsed transfer function for the simplified thrust vector control system for a Saturn-type vehicle was derived. In the simplified thrust vector control system, the bending modes of the vehicle are ignored and the lateral acceleration channel is omitted. Typical data was used in an example, and the uncompensated system was unstable. A digital transfer function was chosen which compensated the system to stability at sampling instances with a gain margin of nine db and a phase margin of 45°. An equivalent continuous-data compensation was employed with the continuous-data system, resulting in the same gain and phase margins. Numerical accuracy was critical for the sampled-data case, with at least eight significant figures required in obtaining the z-transforms. For the example, the system was unstable between sampling instances, indicating what is referred to in current literature as hidden instability. Thus additional compensation would be required in the attitude rate channel. The problem of conpensation in other channels and the effect of the compensation on the dynamic response is not considered. Author

N66-39954# Pan American World Airways, Inc., New York.
EVALUATION OF INERTIAL NAVIGATION SYSTEM IN CIVIL AIR TRANSPORT OPERATIONS. VOLUME III: OPERATIONAL EVALUATION
P. R. J. Reynolds, M. W. Eldred, and W. W. Moss Sep. 1966 115 p
(Contract FA-64-WA-5192)
(RD-66-30; Vol. III)

The accuracy and reliability with which an automatic navigation system, composed of a Litton LN-12 inertial sensor coupled with a Bendix BANC-461 navigation computer, could meet the navigation requirement of a commercial jet aircraft in scheduled North Atlantic operation were investigated. The inertial platform, the Litton and Bendix electronics packages, and the power source were placed in the forward baggage compartment of a DC-8 aircraft. The control/display units were mounted at the observer's station in the cockpit. Signal analogs of track error and lateral displacement were applied to the pilot's pictorial deviation indicator and could also be applied as autopilot inputs, thereby providing automatic track-steering. The results from 87 flights showed the operational accuracy, reliability, and consistency of the system to be good. The total cumulative inertial navigation time was 424.54 hours. The average rate of deterioration in the accuracy of the inertial position while enroute was 1.6 n. mi./hr. The largest single position error was 30.5 n. mi. R.N.A.

N66-39955*# Advisory Group for Aerospace Research and Development, Paris (France).
SPACE NAVIGATION GUIDANCE AND CONTROL
C. S. Draper, W. Wrigley, D. G. Hoag, R. H. Battin, J. E. Miller et al (Mass. Inst. of Tech.) Maidenhead, England, Technivision Ltd., Aug. 1966 375 p refs
(AGARDograph-105) CFSTI: HC $4.25/MF $1.75 CSCL 17G

The general subject of space vehicle control systems is discussed with particular application to the Apollo manned lunar landing program. An historical background to the fundamental problems of guidance and navigation is provided. Basic physical phenomenon and associated instrument techniques are discussed. The problems and approach of the guidance, navigation, and control of the Apollo manned lunar landing mission are considered. Some of the basic philosophy and approaches to the Apollo tasks are illustrated. The analytic foundation for performing on-board calculations for navigation and guidance is given. The achievement of a unified and universal set of equations provides an economy in on-board computer program to perform all mission tasks. The mechanization of the inertial sensor equipment of the Apollo guidance and control system is covered. The same visibility into optical navigation sensors and measurement techniques is provided. The background and specific techniques in the mechanization of on-board digital computers are presented. Specific problems and solutions of vehicle attitude control under conditions of rocket powered flight and free fall coast are included. R.N.A.

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N66-38869# International Atomic Energy Agency, Vienna (Austria).
NUCLEAR ELECTRONICS
C. N. Welsh, ed. 1966 676 p refs In ENGLISH and FRENCH Proc. of the Intern. Atomic Energy Agency Conf. on Nucl. Electron., Bombay, 22-26 Nov. 1965 CFSTI: HC $9.75/MF $3.25

Conference papers on power and neutron flux measurements, reactor control, safety devices, and data processing to ensure optimum operation are presented. For individual titles see N66-38870–N66-38916.

N66-38870# Oak Ridge National Lab., Tenn.
PARALLEL-PLATE MULTISECTION IONIZATION CHAMBERS FOR HIGH-PERFORMANCE REACTORS
D. Roux *In* IAEA Nucl. Electron. 1966 p 3-18 refs Sponsored by AEC (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

A new model of parallel-plate multisection ionization chambers for reactor control applications in high-performance reactors has been developed. The arrangement allows the combination of different active sections in a single reactor penetration. Each active section is composed of parallel plate electrodes each 4.6 cm in diameter and 0.012 cm thick. Ceramic discs are used to anchor the electrode tie rods and to insulate adjacent active sections. The maximum electrical interaction between two adjacent sections is less than 1%. The electrodes are spaced 0.1 cm apart to obtain superior saturation characteristics. The electrodes may be coated with boron-10 for use as neutron-sensitive chambers, with uranium-235 for use as fission chambers, or left uncoated for use as gamma-sensitive chambers. Also, the use of boron-coated and uncoated electrodes appropriately coated and connected will give a gamma-compensated neutron-sensitive chamber. To date, two ORNL reactors are fully equipped with this chamber model. Over a period of 20 months, no failure has occurred. A new electrode configuration is used to achieve an electrically adjustable gamma compensation. The signal electrodes are smaller in diameter than

the positive and negative high-voltage electrodes. If the two polarizing potentials are not equal, the electrical field is slightly distorted near the outside edge of the signal electrodes. By varying the ratio of the two potentials, the]ositive and negative collection volumes of the chamber are changed accordingly. The compensation change is 2%, per 100-V change of the negative polarizing voltage, with the positive voltage equal to 300 V. Experimental results show the insensitivity of the gamma compensation to wide variations in intensity, energy, and geometry of the gamma background. Author

N66-38871# Commissariat a l'Energie Atomique, Grenoble (France). Centre D'Etudes Nucleaires.

LOW VOLTAGE IONIZATION CHAMBER [CHAMBRE D'IONISATION ALIMENTEE EN BASSE TENSION]

J. C. Decuyper and R. Gariod *In* IAEA Nucl. Electron. 1966 p 19–31 In FRENCH; ENGLISH summary (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

The object of the paper is to study the properties of low voltage ionization chambers operating in the recombination condition. Calculations show that the current collected $I = 2I_0/[1+[1+(SI_0/v^n)]^{[1/2]}]$, where I_0 is the current which the chamber would supply in the saturated condition, S is a factor governed by the chamber, v is the supply voltage of the chamber. If $SI_0/v^n < 1$, the chamber is in the saturated condition and $I = I_0 \approx \phi$ (measured flux). If $SI_0/v^n < 1$, the chamber is in the recombination condition and $I \approx 2\sqrt{I_0}\sqrt{v^n/S}$ $I \approx \sqrt{\phi}$. Characteristics of low-voltage ionization chambers are: (a) a simple linear amplifier which can be used over two decades thus yields measurements over four flux decades, since the condition $SI_0/v^n > 1$ giving $I \approx \sqrt{\phi}$ obtains. (b) At high fluxes the measurement is not distorted by non-saturation, since this is the property used to obtain $I \approx \sqrt{\phi}$, hence all the more applicable to high fluxes. (c) The energy response is not changed with respect to saturated chambers. (d) The low voltage (a few volts) calls for a stability which is easy to obtain directly from the supply voltages of the amplifier. With pulsed flux operation the charges collected obey exactly the same law of collection, which is of importance for intense fluxes of short duration. Author

N66-38872# India. Dept. of Atomic Energy, Bombay.

IONIZATION CHAMBERS FOR REACTOR CONTROL

L. Satyanarayana and E. V. R. Rao *In* IAEA Nucl. Electron. 1966 p 33–38 refs (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

Development work was initiated in this laboratory to design suitable uncompensated and compensated ion-chambers for reactor control purposes. The essential difference between our design and the other commercial designs is that our chamber electrodes are supported on both sides, which gives it both a rigid construction and the flexibility of varying the sensitivity by varying the length of the electrodes. It has been possible to achieve good performance even with relatively simple techniques of coating enriched boron, as indicated by the performance of six chambers tested in our swimming-pool reactor. The saturation characteristics and sensitivities observed on these six chambers are remarkably close and reproducible. Earlier chambers were made with stainless steel casings and 2s aluminium electrodes. Later some all-aluminium chambers have also been made, and their performance compared with the former. High purity alumina and ceramic insulators have been used in the construction. It is found that the compensation ratio is sensitive to the value of the polarizing voltages and is constant when the n-γ and γ volumes are connected to equal and opposite voltages. The influence of the polarizing voltages on the compensation ratio is studied in detail. The polarizing voltage for 90% saturation of 100 μA is approximately 125 V for both types of chamber. Author

N66-38873# Commissariat a l'Energie Atomique, Seclay (France). Centre D'Etudes Nucleaires.

NUCLEAR RADIATION DETECTORS FOR REACTOR CONTROL [DETECTEURS DE RAYONNEMENTS NUCLEAIRES POUR LE CONTROLE DES REACTEURS]

J. Duchene and A. Roguin *In* IAEA Nucl. Electron. 1966 p 39–44 In FRENCH; ENGLISH summary (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

Neutron and gamma flux detectors for reactor control, together with equipment for connecting the detectors to the measuring units, are described in the paper. These detectors have been developed with a view to their adaptation to the various conditions of use encountered in reactors. They comprise, inter alia: Compensated or non-compensated boron ionization chambers produced for high-flux technology and intended for operating temperatures up to 250°C; Aluminium high-flux fission chambers for operating temperatures not exceeding 250°C and stainless steel chambers for operation at temperatures up to 400°C; Ionization chambers for intense gamma fluxes; Rapid response, high-flux technology fission chambers, operating at temperatures up to 400°C; Boron-coated proportional counters. All these types of detector can, in addition, be provided with cables, extensions and containers to adapt them for use in the conditions for which they are intended. Author

N66-38874# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.

NEW POSSIBILITIES OFFERED BY BORON AND URANIUM DETECTORS [NOUVELLES POSSIBILITES OFFERTES PAR LES DETECTEURS A BORE ET A URANIUM]

R. Allemand and V. Delcroix *In* IAEA Nucl. Electron. 1966 p 45–55 refs In FRENCH; ENGLISH summary (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

At present three types of detector come under consideration for use in reactor control: fission chambers, boron and BF_3 proportional counters, and ionization chambers. All three detectors employ two nuclear reactions of the type (n,f) and (n,α), the first of which is less probable than the second but provides pulses of greater amplitude. It follows that for a given flux the fission chamber is less accurate than the boron chamber but facilitates the use of pulse techniques, ensuring under certain conditions excellent discrimination of the parasitic gamma flux of the reactor. In order to cover the total power range of a reactor (10 decades) it is therefore necessary to make a suitable choice of both the type of detector and the type of electronic equipment to be used (continuous current or pulse techniques). the idea, which has already been put forward, of covering the total power range by means of a single fission chamber operating first as a pulse chamber and then as a continuous current chamber is justified by the development of pulse systems possessing a large range and enabling one to solve the problem of gamma flux compensation by means of a fixed compensation. In the same way, the replacement of the fission chamber by a non-proportional boron counter having the advantage of greater sensitivity would represent a further step forward. This will become possible with the development of boron chambers with very short collection times (20–40 ns) and of wide-band amplifiers with low background. Autnor

N66-38875# Atomic Energy Establishment, Winfrith (England). Control and Instrumentation Div.

USING NEUTRON FLUX DETECTORS IN-PILE

R. J. Cox, D. Harrison, and A. Goodings *In* IAEA Nucl. Electron. 1966 p 57–71 refs (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

Neutron flux detectors have developed to the stage where they can be used with confidence in-pile in most types of power reactor. The use of such detectors can result in a reduction in cost of measuring power level for control purposes or can be used for localized flux measurements to improve the power distribution throughout the reactor. Information is given on the types of detectors that have recently been developed in the United Kingdom, including performance data and some indication of the uses for which they are suitable. The detectors include a 1-in. diam. pulse counting fission chamber intended for use during start-up, a

high-temperature mean-current chamber using titanium for reactor control use with logarithmic d.c. amplifiers and period meters and two small mean current fission chambers, one of which is only 1/8-in diam. intended for flux scanning purposes. Considerable problems arise in conveying the electrical signals to the outside environment. An account is given of some studies of mineral insulated cables which have adequate electrical and mechanical performance at reactor temperatures. The use is discussed of pulse transformers used in-pile with pulse counting detectors to improve signal-to-noise ratio and reduce the effects of electrical interference. Author

N66-38876# Battelle-Northwest, Richland, Wash.
MICROWAVE DETERMINATION OF NEUTRON FLUXES IN REACTORS
D. P. Brown *In* IAEA Nucl. Electron. 1966 p 73–87 refs (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

Methods presently used for determining neutron flux distributions have characteristic limitations in providing an indication of the flux density at the measuring point. In certain types of reactors, measurement of coolant temperature rise and flow rate provides an averaged value along the entire fuel tube row and this is not indicative of a specific core region. Of interest, then, is an in-core detector that has the ability to measure neutron flux density at a specific location within the reactor, has good transient response to provide immediate indication of flux density, and evidences no deterioration under environmental conditions encountered within reactor cores. In view of these requirements, a technique was investigated for determining in-core neutron flux densities through the use of microwaves. The microwave technique is based on the change in resonant frequency of a microwave cavity that contains a plasma produced by the impinging neutrons. Neutrons, interacting in an (n,p) reaction with ^{3}He contained within the cavity, produce particles which subsequently ionize the gas. Equilibrium is established between free electron production and various dissipative processes. The dielectric constant changes as a function of the average electron density, thus changing the resonant frequency and the cavity Q. Experiments conducted in a Hanford production reactor demonstrated good correlation between the measured frequency shift and the actual flux density in the reactor. Response of the microwave detector is essentially immediate and transient flux changes were readily apparent. Author

N66-38877# Hungarian Academy of Sciences, Budapest. Central Research Inst. For Physics.
AN AUTOMATED DIGITAL APPARATUS FOR MEASURING THE BASIC PARAMETERS OF NUCLEAR DETECTORS
A. Csakany, A. Javor, and F. Vajda *In* IAEA Nucl. Electron. 1966 p 89–98 refs (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

The measurement of the basic parameters of energy-sensitive nuclear detectors (resolution, stability, noise) is simple and well known in principle, but is tedious work in practice. This fact makes the supervision of serially manufactured nuclear probes (photomultipliers, scintillation crystals, semiconductor detectors) especially difficult. The paper discusses the solution of this problem by means of a digital measuring apparatus. The digital operation is obtained by using the proper circuitry of a multichannel pulse height analyser. The stability measuring process is achieved essentially with a peak-position stabilizer and an added pilot-signal generator. The resolving power measurement—for measuring time reduction—is based on a novel principle: two counters are used and the address pulse train plays an important role. The noise measurement is arranged conventionally. A time multiplexing and control unit is added, making it possible to measure six detectors at the same time. The results are in digital form, and displayed on indicator tubes. Print-out facilities and analog outputs are also included. The apparatus measures automatically the resolving power (5–15%), stability (0.1–10%) and noise (1–15 keV) of scintillation probes, using a standard ^{137}Cs source. It is also possible to measure semiconductor detectors, but in that case good-quality charge-sensitive, and window amplifiers are needed. Author

N66-38878# India. Dept. of Atomic Energy, Bombay.
THE NEUTRON FLUX MONITORING SYSTEM AND FLUX DISTRIBUTION IN THE TARAPUR REACTORS
R. D. Jain and U. Venkateswarlu *In* IAEA Nucl. Electron. 1966 p 99–105 refs (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

Because of excessive thickness of water reflectors (~60 cm) in the Tarapur reactors required by engineering design considerations, the feasibility of the use of out-of-core neutron flux detecting system was in doubt. A scheme proposing complete in-core detecting system was found quite inadequate from the point of view of safe operation of the station. A new scheme utilizing a mixed in-core and out-of-core detecting system based on the calculations of neutron and γ-ray flux distributions has been evolved. This paper contains the calculations of the neutron and γ-ray flux distributions and the description of the latest scheme of neutron detecting system to be installed in the Tarapur reactors. Author

N66-38879# Commissariat a l'Energie Atomique, Saclay (France). Centre D'Etudes Nucleaires.
PRESENT STATE OF DEVELOPMENT IN REACTOR CONTROL INSTRUMENTATION DESIGN IN FRANCE [ETAT ACTUEL DU DEVELOPPEMENT DES ETUDES D'INSTRUMENTATION DE CONTROLE DES REACTEURS EN FRANCE]
J. Furet and J. Weill *In* IAEA Nucl. Electron. 1966 p 107–120 refs In FRENCH; ENGLISH summary (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

The authors deal only with the instrumentation for neutron detectors. From the point of view of basic design, development is concentrated on the following: (a) Doing away with pre-amplifiers, or at least increasing the distance between the electronic instrumentation and the detectors (to permit operation under environmental conditions which are normal from the point of view of temperature and radiation); (b) Increasing the measuring range of the pulse assemblies, with improvement in neutron/gamma discrimination; (c) Examining the possibility of using the same detector both for digital techniques and current techniques with a view to increasing the measuring range of neutron detectors; (d) Developing digital measuring techniques. On the technological side the authors describe modular electronic systems which are being developed by industry and which possess the following essential characteristics: avoidance of electronic tubes, systematic use of semiconductors, simplification of maintenance with standardization of functions, adaptation to power reactor control through increased automation and greater centralization of controls and measuring operations. The authors present the results of reactor trials with such systems and of material tests. Author

N66-38880# India. Dept. of Atomic Energy, Bombay.
SOME DESIGN ASPECTS OF THE CONTROL AND SAFETY INSTRUMENTATION OF THE ZERO-ENERGY REACTOR ZERLINA
U. Venkateswarlu, L. Viswantathan, M. G. Pansare, and A. K. Nagle *In* IAEA Nucl. Electron. 1966 p 121–132 refs (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

This paper describes some of the special conditions (such as very low gamma background, low neutron flux levels, flexibility to change or by-pass set procedures for safety and operation in order to facilitate certain experiments, and hence the need for a most reliable safety system) that exist in ZERLINA (Zero Energy Reactor for Lattice Investigations and study of New Assemblies).

and how they influence the design of neutron flux instrumentation used for measurement, control and over-all safety of the reactor. The flux measurement over a range of 6 decades from 10^2 to 10^8 n cm^{-2} s^{-1} is done by linear and logarithmic channels and thus about 4 decades overlapping is provided between start-up channel and high-flux channels. The heart of all the linear, log-period channel is an operational amplifier capable of detecting currents down to 10^{-13} A and each instrument is provided with a built-in test facility to check the calibration and scram level. Another design feature worth noting is a diode-connected electrometer pentode, and by deriving the filament current from the output stage the log characteristics with good accuracy have been achieved from 10^{-7} to 10^{-13} A. The safety amplifier incorporates all the essential features such as simplicity in design, minimum number of components, fail-to-safe condition against all possible failures of components and mal-operation by the personnel and threshold action above the set limit. Author

N66-38881# India. Dept. of Atomic Energy, Bombay.
TRANSISTORIZED INSTRUMENTS FOR REACTOR CONTROL AND FLUX MEASUREMENT
U. Venkateswarlu, S. N. Chakravarti, B. Majumdar, and A. K. Nagle *In* IAEA Nucl. Electron. 1966 p 133–140 refs (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

The necessity of employing semiconductor devices in nuclear reactor instrumentation and control has long been felt because of the basic advantages they offer over vacuum tube devices. Response to such an urge has been initiated with the introduction of the transistorized log-N and period amplifier and picoammeter in the series of nuclear instruments designed by A.E.E.T. These instruments are suitable for nuclear reactor power measurement and control. (a) Log-N period amplifier: in the intermediate range between start-up and full power operation; (b) Picoammeter: from intermediate range to full power operation. The heart of these instruments is a current-sensitive operational d.c. amplifier with 100% negative feedback, which can measure ionization current in the range of 10^{-12} to 10^{-4} A. It has a high-gain, fast-response time with negligible drift and good linearity. The over-all design of the instruments incorporates simplicity with stability and reliability of operation. Some salient design features of the instruments are given in the paper. Author

N66-38882# Japan Atomic Energy Research Inst., Ibaraki.
SOLID-STATE NEUTRON FLUX MONITORING INSTRUMENTS FOR NUCLEAR REACTORS
T. Furukawa and N. Wakayama *In* IAEA Nucl. Electron. 1966 p 141–155 (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

This paper describes solid-state picoammeters, log-N amplifiers and period meters which have been developed for the flux monitoring and control system of the material testing reactor (JMTR). Recent developments and improvements of insulated-gate field-effect transistors (MOS FET's) have enabled us to realize a perfectly transistorized direct-coupled electrometer. The examination of the behaviour of the MOS FET for the ambient temperature variation shows that the voltage drift referred to the gate is higher than that of the ordinary FET, but low enough for picoammeter application. For log-N amplifier applications, selection of the first stage FET or adjustment of the drain current for the individual FET is necessary. The paper also describes the method of compensating the temperature dependence of the log-diode. Balancing out the variation due to the temperature dependent saturation current with an identical diode and compensating the slope by the use of an amplifier having a temperature-dependent gain, a variation of less than 0.1 decades is attained in the range of 3×10^{-12} to 3×10^{-4} A for an ambient temperature variation of 25°C. The authors discuss the non-linear representation of the period-indication to compromise requirements of the expanded scale for the convenience of operation and of compressed scale necessary for period trip. Finally, a description is given of complete picoammeter circuits covering the ranges of 10^{-10} to 10^{-4} A, the 8-decade log-N amplifier covering 3×10^{-12} to 3×10^{-4} A, and the period meter. Author

N66-38883# Atomic Energy Establishment, Winfrith (England). Control and Instrumentation Div.
REDUCING THE EFFECTS OF ELECTRICAL INTERFERENCE ON NUCLEAR INSTRUMENTS
D. Harrison, I. Wilson, and R. J. Cox *In* IAEA Nucl. Electron. 1966 p 157–169 refs (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

An account is given of a research program to study the mechanism by which electrical interference disturbs the correct operation of nucleonic instruments, particularly the wide-bandwidth equipment used with pulse counting types of measurement. One of the principal results of this work is the realization that most sources of interference cause currents to flow through the screening of the measuring installation and that it is this flow of current that causes signals to be generated that interfere with the measurement. Information is given on the characteristics of a variety of coaxial cables from this point of view, indicating which types are to be preferred. A discussion is also given of the influence of these factors on the mechanical design of electronic boxes. Techniques have been developed that, with the establishment of the relevant criteria, allow installations to be measured for their degree of susceptibility to electrical interference. Also the results of these measurements can be used to decide where to make changes to the installation to effect improvements. A large "library" of remedial measures is available and a few examples are given. Author

N66-38889# Osaka Univ. (Japan). Dept. of Nuclear Engineering.
CAPACITANCE-TYPE VOID METER
Y. Sakurai, K. Mori, K. Isozumi, and K. Kazizawa *In* IAEA Nucl. Electron. 1966 p 247–260 refs (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

For studies of the boiling-water nuclear reactor (BWR) and two-phase flow, it is very important to measure the void-fraction, the volume fraction of steam in two-phase flow. This paper reports a method for void-fraction measurement which is based on changes of the equilvalent dielectric constant of the two-phase flow. Preliminary experiments were carried out with both simulated voids in the forms of glass tubes and real voids (air bubbles) in the air-water mixture to investigate the characteristics of the device for the void-fraction measurement (capacitance-type void meter). The basic principle of this void-fraction measuring method is discussed, comparing real voids with equivalent circuits consisting of capacitances and resistances. Experimental results of this void meter applied to a thermodynamic-hydrodynamic loop which simulates the BWR are shown and it is verified that the local void-fraction can be measured with a fast response. As a void detector is used for this device, its shape and dimensions must be investigated before applying the device to the BWR, because the core area into which the detector is to be inserted is limited. Several types of void detectors have been made and examined. The results show that a probe-type electrode has the best characteristics for the purpose. Author

N66-38890# Commissariat a l'Energie Atomique, Chusclan (France). Centre de Production du Plutonium.
CARBON DIOXIDE, THE COOLANT GAS OF THE G2/G3 REACTORS: LEAKS, ANALYSIS, ACTIVITY [L'ANHYDRIDE CARBONIQUE, GAZ DE REFROIDISSEMENT DES REACTEURS G2/G3: FUITES, ANALYSE ET ACTIVITE]
J. Meiffren and F. Dupay *In* IAEA Nucl. Electron. 1966 p 263–296 refs In FRENCH; ENGLISH summary (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

This paper first describes very briefly the coolant gas circuits of the G2 and G3 reactors. The first part of the paper contains a detailed study of gas leaks together with relevant operating results. The classification of CO_2 circuits is based on the kinematics of the gas in the main reactor vessel and in the storage and feed systems. This study is virtually indispensable when the leakage rate is very low (3t/day) in relation to reactor capacity and it helps in the investigation of very small leaks. The second part of the paper describes various installations for chemical analysis and for measuring the activity of the coolant gas of the G2 and G3 reactors, presenting operating results for a period of several years. It also contains an outline of the various methods employed, of modifications and improvements to the original installations made with a view to providing more information about the sensitive and vital points in the installations and about the measurement parameters affecting the behaviour of the reactors (humidity, argon content, etc.). Author

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RUPTURED FUEL LOCATION WITH HIGH-RESOLUTION GAMMA-RAY SPECTROMETERS

J. J. Lipsett *In* IAEA Nucl. Electron. 1966 p 299–321 refs (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

Specific fission products may be measurable in the coolant flow of power reactors with a lithium-drifted germanium γ-ray spectrometer. A channel containing ruptured fuel could be identified in a pressure-tube reactor by γ-scanning the channel outlets. Calculations show that such a location system is feasible if short-lived fission product release rates are adequate, or if long-lived fission products which are released at high rates can be rapidly removed from the recirculating coolant system. Release rates must be measured against a background from uranium contamination on the fuel channel surfaces. The effect of activation products (^{19}O, ^{16}N) must also be considered. The lithium-germanium γ-ray spectrometer has resolutions of 3.5 keV (FWHM) at 120 keV and 7 keV at 1.173 MeV on single sources with full-energy-peak efficiencies of 50 and 0.2% at these energies. Double-escape-peak efficiency has a maximum of 0.5% at 4 MeV. Many specific γ-emitting fission products are identifiable in mixed sources, in the energy band from 80 keV to 6 MeV. Author

N66-38892# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

DEVELOPMENT OF FISSION-PRODUCT DETECTORS FOR THE DETECTION OF BURST FUEL ELEMENT CANS [DEVELOPPEMENT DES DETECTEURS DE PRODUITS DE FISSION POUR LA SURVEILLANCE DES RUPTURES DE GAINES]

J. Graftieaux and A. Roguin *In* IAEA Nucl. Electron. 1966 p 323–332 refs In FRENCH, ENGLISH summary (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

The measurement of fission gases by electric collection is used for detecting burst cans principally in graphite-gas reactor systems. Three types of detector have been developed for general use, the type employed depending on the pressure and temperature of the coolant gas. The authors give examples of their use in EDF power reactor systems, irradiation loops and in the EL.4 reactor cooled by carbon dioxide at a pressure of 60 bars. In the EL.4 reactor the temperature and pressure of the gas at the time of fission product measurement are 200°C and 50 bars respectively. The method of electric collection after extraction of the fission gases dissolved in the water is also used for maintaining a check on the fuel of water-cooled reactors. However, although it is less sensitive, the method of measuring delayed neutrons emitted by the fission products escaping into the water is widely used because of the simplicity of the equipment employed. The method is used in the EL.3, Pégase and Osiris reactors. Author

N66-38893# India. Dept. of Atomic Energy, Bombay.

A MULTICHANNEL ANALYSIS SYSTEM FOR LOW LEVELS OF FISSION PRODUCTS IN REACTOR COOLANTS

S. Ragupathy and K. G. Vohra *In* IAEA Nucl. Electron. 1966 p 333–339 (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

A multi-channel analysis system consisting of a 5-in×4-in. NaI(Tl) crystal and a 256-channel pulse height analyser incorporating ferrite core memory storage is described. This system has been adopted for the measurement of very low levels of fission products in reactor coolants by gamma spectrometry. The pulse height analyser is based on a Hutchinson and Scarrot type analog-to-digital converter using a 2-Mc clock. Binary address and storage system are used for the computer part of the analyser. The memory has a sixteen bit storage capacity. The memory cycle time is 20 μs. Two analog output modes, i.e. a CRT and an X-Y recorder, are provided for rapid identification of the isotopes from the gamma spectra. For accurate measurement and analysis of activities two digital output modes are provided, namely a digital printer and a neon read-out. The system can be used for a very large range of fission-product activity, from very low levels of activity encountered in normal operations to fairly high levels encountered in the case of a split rod. Using the above system, preliminary studies have been made on induced radioactivity and fission-product activities in the reactor cooling water samples. Author

N66-38894# India. Dept. of Atomic Energy, Bombay. Electronics Div.

A NEW DESIGN OF RATIO CIRCUIT FOR FISSION FRAGMENT STUDIES

P. K. Patwardhan and V. S. Indurkar *In* IAEA Nucl. Electron. 1966 p 341–350 refs (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

A pulse-voltage dividing circuit is described for studying the mass distribution of fission-fragments in a multi-parameter experimental set-up. In the present method temperature-compensated amplifiers and zero-trigger technique are used to improve upon the overall-all sensitivity. The special feature of the circuit is that the output is presented in a digital form, improving considerably the over-all circuit performance in terms of fluctuations and linearity. A capacitor is charged with a constant current controlled by one of the input pulses so that the drop across the capacitor increases linearly with time. The ramp so obtained is amplified in conjunction with the other pulse by temperature-compensated amplifiers and then compared. The difference becoming zero causes the triggering of a zero-trigger circuit. The time duration between the start and the instant at which the difference becomes zero is directly proportional to the ratio of the two input pulse amplitudes. A flip-flop is used to generate a pulse whose duration equals this time interval. This "time pulse" which carries the information as the pulse duration is used to gate a fixed frequency oscillator. The output pulses from the gated oscillator are totalized by a scalar and the number of counts are proportional to the ratio of the two input pulse amplitudes. Author

N66-38895# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

DESCRIPTION OF A REACTIVITY MEASURING APPARATUS [DESCRIPTION D'UN TYPE D'APPAREIL DE MESURE DE LA REACTIVITE]

M. Deiss and J. Uberschlag *In* IAEA Nucl. Electron. 1966 p 353-363 ref In FRENCH; ENGLISH summary (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

It seemed desirable to design a type of apparatus capable of evaluating directly and instantaneously the excess multiplication constant δk on the basis of the changes in a physical quantity N

assumed to be proportional to the neutron flux prevailing in the reactor core. The coefficient δk is practically coincident with the reactivity near to criticality. This type of apparatus can therefore resolve the relationship which is the inverse of that defined by the system of differential equations with reference to the reactor, by considering the simplified case of a "point" reactor in the one-group theory. The application of analog computation techniques leads to the utilization of a Pagels-type network arranged either as an input impedance or as a feed-back impedance of an operational amplifier. This latter structure brings about the inversion of the mathematical operator defining the function of the reactor, and has been adopted for the production of the two apparatuses described. The output unit of these various types of instrument consists of a divider extracting the term δk from the product $N\delta k$ supplied by the first stage of the apparatus. The two apparatuses have different dividers in the output unit, in the one case potentiometric, and in the other electronic. The first apparatus is suitable in principle for most normal measurements. The second, by reason of its shorter response time, is suited both to measurements of higher reactivity values with the reactor level rising, and also with the reactor level falling, even over limited power ranges. Author

N66-38896# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.

REACTIMETER [REACTIMETRE]

G. Chauvet, R. Gariod, and E. Tournier *In* IAEA Nucl. Electron. 1966 p 365–378 refs In FRENCH; ENGLISH summary (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

The "reactimeter" is an apparatus by which the reactivity in a reactor, particularly during reactivity transients, can be measured directly and instantaneously. The apparatus has a measuring range from $\pm 50\times10^{-5}$ to $\pm 5000\times10^{-5}$. The accuracy of measurement is $\pm 1\%$ for a power range of about 2.5 decades. From the behaviour of the reactor, given by Nordheim equations, the Pagels circuit enables one to obtain a current $i = K\rho n$, where ρ is the reactivity and n the neutron flux. The Pagels circuit consists of resistor and capacitor subcircuits representing neutron families. An electronic divider enables one to obtain the reactivity term $\rho \approx (k\rho n/n)$ directly. The apparatus is housed in a 3U2 drawer subchassis and consists of a measuring amplifier, Pagels circuit, electronic divider, and LT and HT supply for the compensated ionization chamber. Comparative studies were carried out on the basis of conventional measurements and an accuracy of the order of $\pm 1\%$ was obtained on the following reactors: Alizé (CEN Saclay), Azur (CEN Cadarache) and Siloette (CEN Grenoble). When the period of the reactor is positive no precautions need to be taken with regard to the positioning of the chamber. When the period is strongly negative (shut-down) it is sufficient to arrange the chamber in such a way that part of the core is between the rod being studied and the chamber. In this way rod anti-reactivity can be measured with an accuracy of $\pm 1\%$. The "reactimeter" has several applications: reactor safety; measurement of reactor poisoning; and evaluation of rod anti-reactivity with reactor power rising or falling, of reactor for which the procedure might be suitable. Note: The trials were carried out on the CABRI reactor ($\theta = 5\times10^{-5}$ s). Author

N66-38897# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

PROCEDURE FOR RAPID START-UP—ANALYSIS ON AN ANALOG COMPUTER AND COMPARISON WITH RESULTS OF REACTOR TRIALS [PROCEDURE DE DEMARRAGES RAPIDES—ANALYSE SUR CALCULATEUR ANALOGIQUE ET COMPARAISON AVEC DES ESSAIS REELS]

C. Caillet, M. Deat, J. Furet, and J. Weill *In* IAEA Nucl. Electron. 1966 p 379–394 refs In FRENCH; ENGLISH summary (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

With the automatic start-up procedure described a reactor can pass from any unknown subcritical state to a subcritical state very close to criticality under satisfactory conditions of speed and safety. The principle of the procedure is recapitulated below. The initial reactivity δk_0 is not known; only the neutron level n_0 is available. The rods are withdrawn rapidly at a fast rate "a" until the neutron level rises from n_0 to $n_{10} = qn_0$ (q = 2 being the proportionality factor). The rods are then held for a period Δ at the end of which the level n_{10} has become $n_{1\Delta}$. If $n_{1\Delta} > pn_0$ (p being the proportionality factor optimized at 2.3) the procedure is brought to a stop. If $n_{1\Delta} < pn_0$ the procedure is resumed: rods raised at rate "a", stopped when n reaches $qn_{1\Delta}$, held for period Δ, comparison of $n_{2\Delta}$ with $n_{1\Delta}$. Generally speaking, the procedure is resumed as long as $n_{1\Delta} < pn_{1-1\Delta}$; it is brought to a stop when the opposite state is reached. The authors show the influence of average lifetime ($\theta = 10^{-3}$ to 10^{-7} s), the rate of withdrawal of the rods ($a = 50$ to 200×10^{-5} s) and the measurement parameters (q,p and Δ). They compare the results obtained for the start-up of a reactor in equilibrium (some time after shut-down) and not in equilibrium (shortly after the dropping of the rods). They also compare the results obtained on the analoque computer with the reactor trial values and conclude by considering the types of reactor for which the procedure might be suitable. Note: The trials were carried out on the CABRI reactor ($\theta = 5\times10^{-5}$S). Author

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NEUTRON DYNAMICS OF BROOKHAVEN'S HIGH FLUX BEAM REACTOR

J. Chernick *In* IAEA Nucl. Electron. 1966 p 395–411 refs (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

Brookhaven's High Flux Beam Reactor (HFBR) is a high power density research reactor with many novel features. These include a compact, undermoderated core, cooled, moderated and reflected by high velocity D_2O. Resulting safety features include a long neutron generation time and negative temperature and void coefficients throughout the core and reflector. Dynamic characteristics of the reactor have been explored both by analog and digital computing machines. The temperature coefficients of the reactor include a small fuel expansion coefficient, a large core D_2O expansion coefficient and a very large reflector D_2O expansion coefficient. Control rod action also takes place in the reflector. The ultimate reactor shut-down agent is an aqueous solution of cadmium nitrate. Other conceivable methods of gaining reactivity include the flooding of empty beam tubes or rearrangements of core fuel elements. The reactivity gains have been measured experimentally and calculations show that they are completely tolerable. An anti-critical grid, consisting of a set of stainless steel bars, is mounted in the base of the reactor vessel to prevent criticality in the remote contingency that the core should overheat, melt and resolidify in the bottom of the vessel. Studies of possible experiments to separate the effects of the core and reflector temperature coefficients have also been carried out. Author

N66-38899# Commissariat a l'Energie Atomique, Cadarache (France). Centre d'Etudes Nucleaires.

AUTOMATIC CONTROL SYSTEM OF THE PEGGY REACTOR [SYSTEME DE PILOTAGE AUTOMATIQUE DU REACTEUR PEGGY]

J. Bertrand, D. Desandre Navarre, G. Friedling, and R. Mourchou *In* IAEA Nucl. Electron. 1966 p 413–425 In FRENCH; ENGLISH summary (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

The paper describes the automatic control system designed to replace the previous system of the Peggy reactor. The main characteristics of the system are that it permits: change-over at a constant period of 20 s from an initial to a final power differing by a factor of as much as 10^6; accurate stabilization of the power, the change from a transient to a stabilized state being

made automatically. The equipment consists of a dc linear amplifier, with automatic range commutation from decade to decade, and an assembly of circuits for producing from the signal emitted by the amplifier a signal proportional to the logarithm of the power over six decades. A constant power period is achieved by adjusting the logarithm of the power to a value provided continuously by an electronic programmer which produces a voltage gradient with a slope corresponding to the period of 20 s and a saturation value equal to the logarithm of the power required. When the power approaches the value required, a voltage comparator switches the system to a stabilized state by adjusting the linear power value to the preset value by conventional methods. At the beginning of a transient state the system also functions in reverse, enabling the reactor to pass from a stabilized state to a transient state. The control system also makes it possible to approach the required power level from above or below. Author

N66-38900# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

CONTROL AND SAFETY ASSEMBLY FOR REACTORS OF VERY HIGH FLUX [ENSEMBLE DE PILOTAGE ET DE SECURITE POUR UN REACTEUR A HAUT FLUX]

P. Jover, J. Uberschlag, and J. Furet *In* IAEA Nucl. Electron. 1966 p 435–441 refs In FRENCH; ENGLISH summary (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

The displacement of the autonomous loops which are being tested in the PEGASE high-flux reactor has been the cause of disturbances in the control and safety assemblies based on nuclear detection. Consequently a system has been designed for automatic correction of the amplifier gain. Each assembly has its own automatic system for correcting disturbances in the detector to which it is coupled. The system consists of a servo mechanism which, when activated by the discrepancy between the output signal and the signal emitted by a computer calculating the thermal power, corrects the disturbance by means of a compensating change in amplifier gain. Satisfactory performance is achieved by the use of filters with suitable transfer properties which compensate to some extent for the response time of the thermal power measuring assembly. Performance during transient operation was analysed with the help of an analog computer and the optimum characteristics of the system determined. Provision has been made for disconnection of the correction system if it should fail, while ensuring continuity of operation in cases where a fault occurs in one of the elements. Author

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SYNTHESIS OF AN OPTIMAL CONTROL SYSTEM FOR NUCLEAR REACTOR WITH GENERALIZED TEMPERATURE FEEDBACK

I. Kliger *In* IAEA Nucl. Electron. 1966 p 443–460 refs (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

In changing the power level of large reactors, where local damages might occur, the spatial distribution of the neutron density must be considered. This paper discusses the synthesis problem for a single mode represented by the seven-point reactor kinetic equations, two heat exchange equations and by a generalized coupling term, representing the effects of reactor and coolant temperature, T_R and T_C, on the reactivity. The solution to the point reactor problem, which by itself represents average quantities of the reactor, can be applied, with some modifications, to the spatial dependent case, where each of the modes has to follow a given time function. The control system is synthesized to minimize a performance index S, which is a measure of the deviation of the neutron density n from a desired time function $f_1(t)$, as well as of the deviation of the output power $P(v, T_C)$ from a given time programme f(t). To prevent excessive thermal stresses, the rate of change of the neutron density n has to be kept within reasonable bounds determined by a given time function g(t) and the deviation of ṅ from g(t) is also included in the performance index S to be minimized. The available control variables are the input reactivity ρ and the coolant flow v, which are determined in a form of a control law suitable to be realized as a closed loop control system. The resulting control law, which depends on various reactor parameters and variables that are not known exactly, is sensitive to variations of these parameters. Author

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POWER MEASUREMENT AND AUTOMATIC REACTOR CONTROL BY GAMMA-RADIATION OR CERENKOV-RADIATION

H. Weiss *In* IAEA Nucl. Electron. 1966 p 461–474 refs (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

A power measuring system is described using the gamma and Cerenkov radiation from the reactor core. A measuring device based on the above principle was installed in the Institute's TRIGA-reactor and was tested for power measurements and automatic reactor control. It is possible to mount the detector at some distance from the core with the result that the measurement is not so dependent on local flux variations due to irradiation samples in the core, changes of control rod positions and burn-up of fuel as if the neutron detector were mounted at the reflector. The detectors are free from neutron activation, radiation damage and sensitivity changes due to nuclear reactions in the detector material. Furthermore there are no insulation problems caused by irradiation of insulators. For the measurement of Cerenkov and gamma radiation conventional detectors were used. For fast power indication and automatic reactor control on the prompt fraction of Cerenkov and gamma radiation need be considered. For this purpose the delayed fraction was simulated by a simple electronic circuit and subtracted from the total detector current. To design the simulating circuit the transfer function of the Cerenkov and gamma radiation resulting from a step change of reactor power was obtained by an experimental method described in the paper. Current developments of the system and future applications for different types of reactors including high temperature types and also the design of detector probes are discussed. Author

N66-38903# Commissariat a l'Energie Atomique, Chusclan (France). Centre de Production du Plutonium.

SAFETY SYSTEMS AND THE MEASUREMENT OF NEUTRON FLUX IN THE G-2 AND G-3 REACTORS [REACTEURS G2 ET G3: MESURES DE PUISSANCE ET CHAINE DE SECURITE]

J. Meiffren and F. Decool *In* IAEA Nucl. Electron. 1966 p 475–493 In FRENCH; ENGLISH summary (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

From the outset the control and safety requirements of the G-2 and G-3 reactors have posed two particular problems: the measurement of neutron flux and safe operation based on this measurement. Substantial increases in the power of the reactors since the initial stages of the project have made the modifications described virtually indispensable. By 1962, moreover, the operating experience acquired over several years, together with the constant desire to make maximum provision for reactor safety in all its aspects, and rapid technical progress necessitated the substantial modification of the original installation. It was decided that a new system should be installed which would be completely independent of the original system, fully transistorized and relatively easy to operate. The paper briefly discusses the original flux measurement system and safety devices and describes the new equipment, giving reasons for the choice made. It presents the results of laboratory testing of the equipment, an account of its installation and initial operation, and the operating results obtained over several months. The good results obtained in numerous tests and the satisfactory functioning of the equipment during several months of reactor operation lead one to hope that the new system will fulfill expectations. Author

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PULSE CODING TECHNIQUES FOR REACTOR SAFETY LOGIC SYSTEMS

I. Wilson, R. E. Whyard, and A. B. Keats *In* IAEA Nucl. Electron. 1966 p 497–504 refs (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

Reactor safety logic systems for use on large nuclear power stations must provide an extremely high reliability for shutting down the plant for genuine fault conditions combined with the conflicting requirement of relative freedom from unnecessary shut-downs due to minor faults, particularly in the logic system. Most systems employ redundancy—often in the form of three or more instruments measuring each parameter—together with a majority vote technique. The latter frequently takes the form of danger signals from two out of three instruments measuring the same parameter being necessary to cause shut-down. The use of solid-state logic elements such as transistors has given rise to a rapid advancement of techniques. The paper deals with the majority vote part of such a system and the problem of being able to test that this part of the system is functioning correctly. A number of pulse coding techniques have been developed in which the input from each instrument is a coded pattern of pulses rather than a continuous train of pulses. Under normal conditions these pulse code patterns combine in the majority logic network to produce a continuous train of pulses at the output. If a single input disappears or a fault in the network develops, then the output pulse pattern changes giving information on the fault but not causing plant shut-down. A majority of inputs missing gives zero output and results in shut-down. Information is given on two different types of system that have these properties. Author

N66-38905# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

EVOLUTION OF SAFETY SYSTEMS FOR THE CONTROL OF CEA REACTORS [EVOLUTION DE LA SECURITE DANS LE CONTROLE DES REACTEURS AU COMMISSARIAT A L'ENERGIE ATOMIQUE]

J. Furet *In* IAEA Nucl. Electron. 1966 p 505–516 refs In FRENCH; ENGLISH summary (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

The evolution of the safety systems is the result of many years' experience of reactor operation, improved knowledge of reactor dynamics, the considerable progress in safety studies, new control techniques (in particular the rapid spread of automation), the improved performance of measuring equipment, and with advances in electronic technology. In describing the evolution of safety systems for reactor control the author analyses each of these points, taking into account past experience, current projects, operational needs and present safety requirements. Since a compromise has to be reached one must define the requirements to be met by the entire reactor control system envisaged. The author considers these requirements in relation to various types of reactor, paying particular attention to two essential aspects of safety: level safety and interlock safety. The paper stresses that the present development of instrumentation is making it increasingly possible to meet the standards required, thus considerably enhancing the safety of reactor operation. Author

N66-38906# India. Dept. of Atomic Energy, Bombay.

SOLID-STATE LOGIC FOR REACTOR SAFETY SYSTEMS

S. V. Kasargod *In* IAEA Nucl. Electron. 1966 p 517–525 refs (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

This paper describes a transistor-diode logic system for reactor safety and interlock functions. The system uses modular construction with four basic types of modules and is designed to fail-safe against the more plausible internal faults in the system. The modules use selected components and potted circuitry. Some of the special advantages of this system are higher reliability, longer life, less maintenance and safety against unintentional disabling of the system by "by-pass" operations. Factors to be considered in the design of systems are discussed by taking the example of a typical reactor scram line. Sound design calls for proper grouping of inputs to the system, and a judicious use of the principle of redundancy. The design of the modules is briefly outlined. Such design must take into account factors such as ambient temperature variation, supply fluctuations, component tolerances and drifts, and loading conditions. If germanium devices are to be used successfully at higher ambient temperatures, positive cut-off biasing becomes essential. Procedures for testing these modules during production and while in use are also given. Improvements possible in the logic modules by using silicon devices and printed circuits are discussed. Advantages of integrated circuits for modules are also considered. Although field experience is not available on our system at present, laboratory experience with a mock-up system shows good promise. Author

N66-38907# Atomic Energy Commission Research Establishment, Riso (Denmark).

IMPROVEMENT OF REACTOR SAFETY-SYSTEM RELIABILITY BY MEANS OF REDUNDANCY

P. Timmermann *In* IAEA Nucl. Electron. 1966 p 527–543 refs (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

In reactor safety it is generally accepted that the essential reliability factors are the concept of safe and unsafe failures, the fail-to-safety principle, redundancy and testing of safety equipment. The main contributions, especially concerning the two-out-three system, are reviewed in the light of these factors, and the possible causes of the existing discrepancies between the theoretical models and operating experience are discussed. It is indicated that certain extensions of the present models may facilitate the proper design and maintenance procedure. The redundancy problem in general digital circuits has many counterparts in safety systems. The safety channels, used as on-off devices, as well as the logical decision elements, which are usually disregarded in models, may be analysed from this point of view. Some methods of applying redundancy on the logical level are discussed in connection with a replacement of relays by solid-state circuits. Progress here has been rather slow, and several designs have been suggested which overcome the problems of logical element reliability by extensive use of fail-to-safety philosophy and self-checking in non-redundant systems. Author

N66-38908# Groupement Atomique Alsacienne Atlantique, Le Plessis-Robinson (France).

DESIGN FOR EXPERIMENTAL REACTOR SAFETY CIRCUITS INVOLVING NUMERICAL DATA PROCESSING [CONCEPTIO DES CIRCUITS DE SECURITE D'UN REACTEUR EXPERIMENTAL COMPORTANT UN TRAITEMENT NUMERIQUE DES INFORMATIONS]

G. di Giacomo *In* IAEA Nucl. Electron. 1966 p 545–556 In FRENCH; ENGLISH summary (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

The paper gives a brief description of the reactor, followed by an exposition of the principles underlying the design of the safety circuits, stress being laid on problems of redundancy of measurements and of inter-signal coincidences. The data processing computer plays a part in the safety of the reactor. Its role in the safety circuits is defined, together with the extent of its participation in the triggering of corrective action. A brief description is given of the general structure of the safety circuits showing the application of the above principles and the structure of the numerical data processing with the essential features associated with safety. These include in particular the duplication of certain units and the separation of measurement channels. In view of the complexity of the circuits, tests are arranged under load conditions, to check their proper operation. The various test systems are described, including the following: (1) The fine pulse test, giving a check on the proper operation of the whole safety logic including the safety rod holding magnets. (2) Tests of data processing. These tests will automatically cause the switch-over to the duplicate units. The paper concludes with a description of the technology underlying the safety circuits; emphasis is placed on matters of reliability of both components and sub-assemblies. Author

N66-38912# Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics.

DETERMINATION OF THE OPTIMUM NUMBER OF SIMULTANEOUSLY MEASURABLE PARAMETERS

Z. Naray *In* IAEA Nucl. Electron. 1966 p 607–612 refs (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

Nuclear measuring instruments have been designed for the simultaneous measurement of an increasing number of parameters and this development has found its expression in the ever-increasing application of multiparameter analysers. Such a solution, however, is justified only in the case of an ideal measuring instrument, i.e. when both the dead time of the measuring instrument compared with the average time interval between the investigated events and the ratio of time of repair to the mean time between failures are small. Moreover the simultaneous measurements of many parameters requires a more complex instrument which in turn generally has longer dead time, a higher probability of failure, etc. This means that the characteristic data of the real instrument determine the optimal number of parameters which may be measured simultaneously with the particular instrument. In the present work a mathematical formulation of this problem is given. A system of equations is derived which has to be solved using as auxiliary condition the minimalization of the measuring time. As examples of application of the method a few typical measuring problems of low-energy nuclear physics are dealt with. Finally, the possible extension of method to, e.g., simultaneous optimization of the measurement and the reduction of the measured data is discussed. Author

N66-38913# United Kingdom Atomic Energy Authority, Harwell (England).

STEPPING MOTORS AND ASSOCIATED ELECTRONIC CIRCUITS FOR REACTOR CONTROL

E. S. F. King *In* IAEA Nucl. Electron. 1966 p 613–622 refs (See N66-38869 24-22) CFSTI: HC $9.75/MF $3.25

Electrical stepping motors are now available which, because of their high torque and precise motion, are very suitable for use with reactor control rods. A typical motor will produce a torque of about 30 kg cm at 10 rev/min and make about 150 steps per revolution, so that a positional accuracy of 1 part in 10,000 can be obtained on the control absorber. The motors may have three or four windings and are driven by dc pulse-generators specially designed for the particular reactor application. The low-frequency pulses may be produced in many ways, including: (a) rotating shutters moving over photo-transistors, (b) assemblies of standard computing elements, such as synchro-transmitters, and (c) circuits which cause frequency-reduction and squaring of the 50 c/s or 60 c/s electrical supply. It is advisable to arrange variation of the on/off ratio of pulses to obtain maximum torque or reduce energy losses in the motors. The usual electronic circuit consists of binary frequency-dividing circuits connected to Schmitt trigger circuits which switch a low-voltage dc supply to the motors via transistor amplifiers. A typical design will permit an absorber to be driven in steps over 60 cm in 5, 10, 20, 40, 80 or 160 min in the direction required. Author

N66-39210# Battelle Memorial Inst., Columbus, Ohio.

PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING MARCH, 1966

Donald L. Keller 1 Apr. 1966 42 p refs
(Contract W-7405-ENG-92)
(BMI-1767) CFSTI: HC $2.00/MF $0.50

Research progress on reactor materials and components, fuels, UN–PuN fuel materials, a portable smoke photometer, coated-particle fuel materials, and corrosion studies of fluidized-bed fluoride volatility processes. NSA

N66-39610*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PERFORMANCE EVALUATION OF THREE-STAGE PROTOTYPE NERVA TURBINE DESIGNED FOR BLADE-JET SPEED RATIO OF 0.107

Harold E. Rohlik and Milton G. Kofskey Washington, NASA, Jan. 1963 31 p refs
(NASA-TM-X-719) CFSTI: HC $2.00/MF $0.50 CSCL 21F
(Declassified)

Turbine performance is presented in terms of efficiency, weight flow, work, and torque over ranges of speed and pressure ratio. Results for the individual turbine stages as well as the complete turbine are presented. Also included are a performance comparison with other turbines designed for low blade-jet speed ratios and a discussion of design modifications that could be made to improve performance. Author

N66-39612*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

INVESTIGATION OF EIGHT-STAGE BLEED-TYPE TURBINE FOR HYDROGEN-PROPELLED NUCLEAR ROCKET APPLICATIONS. II: EXPERIMENTAL OVERALL AND STAGE GROUP PERFORMANCE DETERMINED IN COLD NITROGEN

Harold E. Rohlick Washington, NASA, Mar. 1962 36 p refs
(NASA-TM-X-481) CFSTI: HC $2.00/MF $0.50 CSCL 21F
(Declassified)

Over-all performance of four- and six-stage assemblies as well as the complete eight-stage turbine is presented in terms of efficiency, specific work, torque, and weight flow. Performance of the four two-stage groups within the eight-stage assembly is shown for design over-all conditions. Also included is a description of design modifications that could be made to improve performance over that obtained. Author

N66-39613*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

INVESTIGATION OF THE EIGHT-STAGE BLEED-TYPE TURBINE FOR HYDROGEN-PROPELLED NUCLEAR ROCKET APPLICATIONS. I: DESIGN OF TURBINE AND EXPERIMENTAL PERFORMANCE OF FIRST TWO STAGES

Harold E. Rohlik Washington, NASA, May 1961 39 p refs
(NASA-TM-X-475) CFSTI: HC $2.00/MF $0.50 CSCL 21F
(Declassified)

Design information includes work division among stages, aerodynamic design, and blade geometry. Turbine performance is presented in terms of specific work, speed, weight flow, and efficiency with the effect of the second stage on first-stage performance at design operation included. Author

N66-39615*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ANALYSIS OF TOPPING AND BLEED TURBOPUMP UNITS FOR HYDROGEN-PROPELLED NUCLEAR ROCKETS

David G. Evans and James E. Crouse Washington, NASA, Jun. 1960 45 p refs
(NASA-TM-X-384) CFSTI: HC $2.00/MF $0.50 CSCL 21F

The turbopump units analyzed were a bleed, a hot-topping (full-flow turbine), and a cold-topping unit. The types of configuration required and their effect on rocket gross weight were investigated. The scope of the analysis did not include the effects of the turbopump configurations on the weights of associate components, such as the reactor. Author

N66-39722*# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mechanical Engineering.

TRANSIENT DYNAMICS AND THERMAL STRESS FOR NUCLEAR ROCKET HEAT-EXCHANGER

T. C. Liu and C. N. Shen 7 Sep. 1966 77 p refs
(Grant NsG-14-59)
(NASA-CR-78947; AC-5) CFSTI: HC $3.00/MF $0.75 CSCL 18I

The equivalent one-dimensional approach for the transient heat transfer problem in a nuclear reactor is discussed in detail. From this approach, the temperature distribution of fuel element and coolant channel are obtained in simple form and with sufficient accuracy. The transient thermal stresses are proportional to the difference of temperature between the fuel element and coolant channel. The analytical solutions of the thermal transient and stresses are given for a sudden change of the hydrogen flow. From several numerical examples, it is shown that the transient thermal stresses can be much higher than the steady-state full power thermal stresses. The maximum transient to steady-state full power thermal stresses should be limited to a proper ratio to ensure that the design of the reactor is within the margin of safety. Author

N66-39738# Naval Radiological Defense Lab., San Francisco, Calif.

MONTE CARLO TECHNIQUE APPLIED TO THE CALCULATION OF GAMMA-RAY TRANSPORT IN COMPARTMENTED STRUCTURES

Le Roy G. Haggmark 3 May 1966 35 p refs

(USNRDL-TR-1038; AD-637685) CFSTI: HC $2.00/MF $0.50

A Monte Carlo computer code was assembled to calculate the transport of gamma rays in three-dimensional, rectangular geometry. The code uses the statistical estimation technique to compute the flux and dose at several space points. The code was applied to two compartmented iron structures that had been experimentally investigated. The Monte Carlo and experimental results compare well, i.e., within 20 percent, in most cases. In a few cases for one structure, where the radiation was incident at large angles from the normal to one wall, the comparison between the results was less than satisfactory. The experimental value was a factor of 6 greater that the Monte Carlo value in the worst case Author (TAB)

N66-39803# Naval Civil Engineering Lab., Port Hueneme, Calif.

DIFFERENTIAL NEUTRON ALBEDO FOR THIN SLABS Technical Report, Sep. 1964–Jan. 1966

D. R. Doty Aug. 1966 71 p refs

(R-465; AD-637579) CFSTI: HC $3.00/MF $0.75

Data giving the experimental angular distribution of differential albedo for thermal neutrons incident upon thick scatters of lead, high density concrete, and iron have been collected. Differential albedo of thermal neutrons on aluminum, iron, and polyethylene as a function of the materials thickness for a given incident and exit angles is shown. These data are compared with a theoretical formula. Experimental verification of the theoretical formula is quite good for the angular variables. Asymptotic limits of the formula for thick and thin scatters are as would be expected physically. The exponential dependence of the formula upon thickness agrees roughly within experimental errors. Reasons for inaccuracies in the magnitude of differential albedo are discussed. An extension to general albedo measurements for thin scatterers at any energy is described. This method, employing elemental scatterers, is shown to yield reliable results in the thermal region when the thickness of the material is less than one mean free path. The method also does away with the need for a collimated detector in differential albedo measurements for thin scatterers. Author (TAB)

N66-39812# United Kingdom Atomic Energy Authority, Dounreay (Scotland).

REVIEW OF THE RECENT OPERATIONAL AND IRRADIATION TESTING PROGRAMME OF THE DOUNREAY FAST REACTOR

R. R. Matthews 26 Jul. 1966 15 p Submitted for Publication

(TRG-1292(D)) CFSTI: HC $1.00/MF $0.50

The first objective of the fast reactor was to demonstrate the feasibility of fast breeders as energy sources for power stations. Now that this has been proved by many years of operational experience and the production of considerable amounts of energy in the form of heat and electricity, the main purpose of the fast reactor is to serve as a fast flux test facility. This is primarily for developing fuels for a prototype fast power reactor. This has already been done in kilogramme quantities in development facilities, based on uranium-plutonium oxides and carbides, and tested to high burn-up. Author

N66-39829# United Kingdom Atomic Energy Authority, Harwell (England). Radiological Protection Div.

ASSESSMENT OF THE EFFECTS OF RELEASES OF ACTIVITY IN THE UPPER ATMOSPHERE DUE TO POSSIBLE BURN-UP OF ISOTOPIC POWER GENERATORS

Pamela M. Bryant Sep. 1966 11 p refs

(AHSB/RP/-M-41)

The potential applications of isotopic generators as sources of auxiliary power in space involve quantities of radionuclides sufficient to produce up to 1 kilowatt (electrical) of power. As the overall rate of future failures in the upper atmosphere, resulting in burn-up of all or most of the initial activity, is likely to be low, consideration is given to the possible consequences of burn-up of a single 1 kilowatt generator fueled with any of nine nuclides selected for study. Prediction of the activity in surface air and in milk is based on data from weapons tests, and predicted activities are compared with reference levels derived for the purpose. It appears that more than ten such generators fueled with plutonium 238 or strontium 90, the nuclides which would present more potential problems than the others studied, could be burned up without the reference levels being exceeded and that only if the rate of failure involving premature or unplanned burn-up were to be much greater than the low rate anticipated would some restriction on their use in space be necessary. Author

N66-39841# United Kingdom Atomic Energy Authority, Harwell (England). Research Reactors Div.

SOME THERMAL-NEUTRON FLUX MEASUREMENTS IN A MOCK-UP OF A DIDO 2V FUEL-PLATE TEST RIG

I. S. Mc Gill and M. J. Crook Aug. 1966 23 p

(AERE-M-1785) HMSO: 3s 6d

The results of thermal-flux measurements in a mock-up of an H_2O-cooled fuel-plate test rig are reported. The measurements were performed in a simulated DIDO 2V position in the DAPHNE/PLUTO mock-up. The results obtained show that substantial edge peaking of the thermal flux, and hence of the heat generation, is to be expected in the irradiation of small highly enriched fuel plates in the DIDO/PLUTO reactors. The suppression of the end peaking by the use of short neutron-absorbing shutters is demonstrated. The alternative procedure of framing the plate with strongly absorbing material to withdraw the end peaking beyond the edges of the fuel has not been studied experimentally. The required frame thickness can however be inferred from the width of the region of flux peaking. Author

N66-39880# Atomic Energy Establishment, Winfrith (England). General Reactor Physics Div.

THE CONVERSION AND FAST FISSION RATIOS IN AN AGR CLUSTER. COMPARISON OF EXPERIMENT AND THEORETICAL RESULTS

J. D. Macdougall Jun. 1966 16 p refs

(AEEW-M-654) HMSO: 2s 6d

Comparison of calculations using the Argosy method (which uses basic data) with experimental buckling measurements on a large number of uranium and uranium dioxide fuelled graphite lattices showed a systematic error, which could be largely removed by decreasing the total resonance integral of the fuel by about 10% in the Argosy calculations. This paper is primarily concerned with confirming the validity of this reduction of the resonance integral by the interpretation of relative conversion ratio and fission ratio experiments. A reduction of $6 \pm 3\%$ in the resonance integral is found to be required to give agreement with experiment. This is in agreement with the 10% mentioned previously when the hydrogen content of graphite is allowed for. Author

N66-39926*# Lockheed-Georgia Co., Marietta.
EFFECT OF NUCLEAR RADIATION ON MATERIALS AT CRYOGENIC TEMPERATURES Quarterly Report No. 4, Apr. 21–Jul. 21, 1966
C. A. Schwanbeck Aug. 1966 95 p refs
(Contract NAS3-7985)
(NASA-CR-72056; LAC-ER-8673) CFSTI: HC $2.50/MF $0.75 CSCL 18J

The recovery for the cryogenic depression of the F_{ty}/F_{tu} ratio in Aluminum 1099-H14 (unirradiated) was observed to be an essentially linear function of irradiation level. After 3×10^{17}n/cm^2(E>0.5 MeV), this parameter at 30°R is over 70% of its initial room temperature value, indicating a similarity between irradiation effect and work hardening. There was no significant difference between the mechanical properties of Aluminum 1099 after irradiation to 10^{17}n/cm^2(E>0.5 MeV) at 30°R followed by annealing and testing at several higher temperatures, and the same properties from specimens, both irradiated to 10^{17}n/cm^2(E>0.5 MeV) and tested at the higher temperatures. However, significant variation was observed between the residual irradiation effects after annealing when tested at the annealing temperature and when re-cooled to the irradiation temperature prior to test. Increases in strength functions, accompanied by moderate reductions in ductility were observed in the three titanium alloys for which testing was complete. There was no evidence of saturation at 10^{18}n/cm^2 (E= 0.5 MeV). Author

N66-39987*# Westinghouse Electric Corp., Pittsburgh, Pa. Atomic Power Div.
FEASIBILITY OF A CHEMICAL POISON LOOP SYSTEM
W. F. Eanes, D. N. Fultonberg, E. R. Rosal, W. D. Fletcher, and J. J. Loving Sep. 1966 76 p refs
(Contract NAS3-5215)
(NASA-CR-72105; WCAP-2993) CFSTI: HC $2.50/MF $0.75 CSCL 18I

The final experiments performed with the Laboratory Version of the Chemical Poison Loop System (CPLS) are described and the results are analyzed. An overall discussion of the feasibility of using a CPLS to control the reactivity of a rocket reactor is contained, wherein it is concluded that the system should be hydraulically and thermally feasible. However, certain chemical instability problems which were not resolved in the work performed make overall feasibility marginal. Author

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N66-39068# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
JOURNAL OF APPLIED MECHANICS AND TECHNICAL PHYSICS
28 Feb. 1966 338 p refs Transl. into ENGLISH of Zh. Prik. Mekhan. I. Techn. Fiz. (Moscow), no. 3, 1964 p 1–185
(FTD-MT-64-319; TT-66-62026; AD-636992) CFSTI: HC $7.00/MF $1.75

In the articles presented, attention is focused on studies related to crack propagation, ionized gases, anisotropic creep, radiation cooling, gas flows, propellant burning velocities, hydrodynamics, boundary layers, viscoelasticity, magnetohydrodynamics, and cavitation. M.G.J.

N66-39095# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RESEARCH OF SPEED OF SOUND IN LIQUID AND GASEOUS ARGON
I. S. Radovskiy *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 308–312 refs (See N66-39068 24-23) CFSTI: HC $7.00/MF $1.75

Graphical and tabulated data are presented on the results of systematic measurements on the speed of sound and the density in gaseous and liquid argon. The simultaneous measurements were taken by isochores in the 84° to 173°K range, and at pressures of 1 to 60 bar, including the critical region. M.G.J.

N66-39240# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A WAVEGUIDE LOADED BY DIELECTRIC DISKS AND WORKING ON A TRAVELING $\pi/2$-WAVE
N. A. Khizhnyak *In its* Theory and Design of Linear Accelerators 28 Feb. 1966 p 257–265 ref (See N66-39226 24-24) CFSTI: HC $7.50/MF $2.00

Calculations of equations concerning the dispersion, phase speed, power flux, and electrical and magnetic field components of a waveguide loaded with solid dielectric disks and working on a traveling $\pi/2$ wave are presented. Values obtained were plotted; and curves showing the dependencies of phase speed, effective dielectric constant, and high frequency capacity flow on the waveguide radius and on the distance between disks, are depicted. L.S.

N66-39266# London Univ. (England). King's Coll.
RESEARCH PROGRAM IN RELATIVITY PHYSICS Final Scientific Report, 1 Nov. 1960–31 Jul. 1965
H. Bondi Wright-Patterson AFB, Ohio, ARL, Apr. 1966 466 p refs
(Contract AF 61(052)-457)
(ARL-66-0075; AD-636507) CFSTI: HC $7.80/MF $2.25

Articles on gravitational radiation, the epistomological foundations of general relativity and its relation to microphysics, high gravitational potentials, slowly changing fields, and special solutions are presented. For individual titles see N66-39267–N66-39287.

N66-39267# London Univ. (England). King's Coll.
GRAVITATIONAL WAVES
H. Bondi *In its* Res. Program in Relativity Phys. Apr. 1966 p 8–17 refs Repr. from Endeavour, v. 20, no. 79, Jul. 1961 p 121–130 (See N66-39266 24-23) CFSTI: HC $7.80/MF $2.25

Such aspects of physics as Newtonian dynamics, electromagnetism and special relativity, gravitation, and the quantum theory are examined in relation to the theory of gravitational waves. The problems inherent in the experimental study of such waves are considered, and it is pointed out that experiments are necessarily confined to mathematical investigations, based on Einstein's general theory of relativity. M.G.J.

N66-39268# London Univ. (England). King's Coll.
ON THE RECEPTION OF ELECTROMAGNETIC WAVES
H. Bondi *In its* Res. Program in Relativity Phys. Apr. 1966 p 18–26 Repr. from Proc. Roy. Soc., ser. A, v. 261, 1961 p 1–9 (See N66-39266 24-23) CFSTI: HC $7.80/MF $2.25

The energy that can be obtained from an electromagnetic wave by a localized receiver is considered for the nonharmonic case. If the currents in the receiver are chosen so as to maximize the amount of energy obtained, with conditions implying that the receiver is quiescent outside a finite interval of reception, then there exists a well-defined maximum. For a limited interval of transmission, this maximum depends closely on the length of the interval of reception. If the restriction on the receiving current is

relaxed, then there exist circumstances in which the wave theory considerations must be supplemented by allowing for induction effects. Author

N66-39269# Southampton Univ. (England).
GRAVITATIONAL WAVES IN GENERAL RELATIVITY. V: AN EXACT SPHERICAL WAVE
L. Marder *In* London Univ. Res. Program in Relativity Phys. Apr. 1966 p 27–32 refs Repr. from Proc. Roy. Soc., ser. A, v. 261, 1961 p 91–96 (See N66-39266 24-23) CFSTI: HC $7.80/MF $2.25

A construction is given for an exact solution of Einstein's empty space-time field equations representing an axially symmetric pulse wave with the properties that (1) the wave front is a sphere, outside of which all space-time is flat; (2) a finite, expanding line singularity forms the axial diameter of this sphere. Because of (1), the solution would need to be generalized before a physical source could be introduced. The presence of radiation is confirmed by the fact that at a great distance from the center of the wave the Riemann tensor is asymptotically of Petrov's canonical type II (with vanishing scalar invariants). Author

N66-39270# London Univ. (England). Dept. of Mathematics.
GRAVITATIONAL WAVES IN GENERAL RELATIVITY. VI: THE OUTGOING RADIATION CONDITION
R. K. Sachs *In its* Res. Program in Relativity Phys. Apr. 1966 p 33–62 refs Repr. from Proc. Roy. Soc., ser. A, v. 264, 1961 p 309–338 (See N66-39266 24-23) CFSTI: HC $7.80/MF $2.25

A covariant formulation of the outgoing radiation condition for gravitational fields is proposed. The condition is based on a detailed examination of the geometry of null lines and of the algebraic and differential properties of the Riemann tensor. It relates the absence of incoming radiation, in a gravitational field with bounded sources and Euclidean topology, to the asymptotic behavior of the Riemann tensor. Fields that are algebraically special in the Petrov classification are highly special examples of fields obeying the suggested condition. Author

N66-39271# London Univ. (England). King's Coll.
SOME SPHERICAL GRAVITATIONAL WAVES IN GENERAL RELATIVITY
I. Robinson and A. Trautman *In its* Res. Program in Relativity Phys. Apr. 1966 p 63–73 refs Repr. from Proc. Roy. Soc., ser. A, v. 265, 1962 p 463–473 Sponsored by ONR, AF, and USF (See N66-39266 24-23) CFSTI: HC $7.80/MF $2.25

Einstein's equations for empty space are solved for the class of metrics which admit a family of hypersurface-orthogonal, nonshearing, diverging null curves. Some of these metrics may be considered as representing a simple kind of spherical, outgoing radiation. (Among them are solutions admitting no Killing field whatsoever.) Examples of solutions to the Maxwell–Einstein equations with a similar geometry are also given. Author

N66-39272# Syracuse Univ., N. Y.
AN APPROACH TO GRAVITATIONAL RADIATION BY A METHOD OF SPIN COEFFICIENTS
Ezra Newman and Roger Penrose *In* London Univ. Res. Program in Relativity Phys. Apr. 1966 p 74–88 refs Repr. from J. Mathematical Phys., v. 3, no. 3, May–Jun. 1962 p 566–578 Sponsored by Aeron. Res. Lab. (See N66-39266 24-23) CFSTI: HC $7.80/MF $2.25

A new approach to general relativity by means of a tetrad or spinor formalism is presented. The essential feature of this approach is the consistent use of certain complex linear combinations of Ricci rotation coefficients which give, in effect, the spinor affine connection. It is applied to two problems in radiation theory: a concise proof of a theorem of Goldberg and Sachs, and a description of the asymptotic behavior of the Riemann tensor and metric tensor, for outgoing gravitational radiation. Author

N66-39273# Cambridge Univ. (England). Dept. of Applied Mathematics and Theoretical Physics.
ON THE RADIATION FIELD OF THE PULSE SOLUTIONS OF THE WAVE EQUATION
F. G. Friedlander *In* London Univ. Res. Program in Relativity Phys. Apr. 1966 p 89–101 refs Repr. from Proc. Roy. Soc., ser. A, v. 269, 1962 p 53–65 (See N66-39266 24-23) CFSTI: HC $7.80/MF $2.25

This paper deals with solutions u of the wave equation that are defined in the exterior of a fixed sphere $r=a$, for $t>r$, and that vanish when $t=4$. It is shown that the limit $f(\theta,\phi,\tau)=\lim_{r\to\infty}\{ru(r,\theta,\phi,r+\tau)\}$ then exists for $\tau>0$, and that $f\equiv 0$ implies that $u\equiv 0$ in $t>r>a$, so that such a solution is uniquely determined by its radiation field f. It is further shown that when f is a regular analytic function of θ and ϕ on the unit sphere, then the formal series expansion converges when $|t-r|/|r|$ is sufficiently small. Finally, it is shown that when f is independent of ϕ (axial symmetry) and an analytic function of $\cos\theta$, then u can be expressed in terms of f by means of a simple integral representation. Author

N66-39274# London Univ. (England). King's Coll.
GRAVITATIONAL WAVES IN GENERAL RELATIVITY. VII: WAVES FROM AXI-SYMMETRIC ISOLATED SYSTEMS
H. Bondi, M. G. J. van der Burg, and A. W. K. Metzner *In its* Res. Program in Relativity Phys. Apr. 1966 p 102–133 refs Repr. from Proc. Roy. Soc., ser. A, v. 269, 1962 p 21–52 (See N66-39266 24-23) CFSTI: HC $7.80/MF $2.25

Some general considerations about gravitational radiation are followed by a treatment of the scalar wave equation in the manner later to be applied to Einstein's field equations. A coordinate system is specified for investigation of outgoing gravitational waves from an isolated axisymmetric reflexion-symmetric system. The metric is expanded in negative powers of a suitably defined radial coordinate, and the vacuum field equations are investigated in detail. It is shown that the flow of information to infinity is controlled by a single function of two variables called the news function. The transformations leaving the metric in the chosen form are determined. The mass of the system is defined in a way which in static metrics agrees with the usual definition. The principal result of the paper is then deduced, namely, that the mass of a system is constant if and only if there is no news; if there is news, the mass decreases monotonically so long as it continues. The linear approximation is discussed, and employed in the analysis of a receiver for gravitational waves. Sandwich waves are constructed, and certain nonradiative but nonstatic solutions are discussed. Author

N66-39275# London Univ. (England). King's Coll.
GRAVITATIONAL WAVES IN GENERAL RELATIVITY. VIII: WAVES IN ASYMPTOTICALLY FLAT SPACE-TIME
R. K. Sachs *In its* Res. Program in Relativity Phys. Apr. 1966 p 134–157 refs Repr. from Proc. Roy. Soc., ser. A, v. 270, 1962 p 103–126 (See N66-39266 24-23) CFSTI: HC $7.80/MF $2.25

Gravitational fields containing bounded sources and gravitational radiation are examined by analyzing their properties at spatial infinity. A convenient way of splitting the metric tensor and the Einstein field equations, applicable in any space-time, is first introduced. Then suitable boundary conditions are set. The group of coordinate transformations that preserves the boundary conditions is analyzed. Different possible gravitational fields are characterized intrinsically by a combination of characteristic initial data, and Dirichlet data at spatial infinity. To determine a particular solution one must specify four functions of three variables and three functions of two variables; these functions are not subject to constraints. A method for integrating the field equations is given; the asymptotic behavior of the metric and Riemann tensors for large spatial distances is analyzed in detail; the dynamical variables of the radiation modes are exibited; and a superposition principle for the radiation modes of the gravitational field is suggested. Author

N66-39276# London Univ. (England). King's Coll.
GRAVITATIONAL RADIATION
F. A. E. Pirani *In its* Res. Program in Relativity Phys. Apr. 1966 p 158–193 refs Submitted for Publication (See N66-39266 24-23) CFSTI: HC $7.80/MF $2.25

A survey of gravitational radiation theory up to the end of 1961, with some technical details, but no calculations. Author

N66-39277# London Univ. (England). King's Coll.
THE LIGHT-CONE AT INFINITY
Roger Penrose *In its* Res. Program in Relativity Phys. Apr. 1966 p 194–203 refs (See N66-39266 24-23) CFSTI: HC $7.80/MF $2.25

From the point of view of the conformal structure of space–time, points at infinity can be treated on the same basis as finite points. Minkowski space can be completed to a highly symmetrical conformal manifold by the addition of a null cone at infinity—the absolute cone. Owing to their conformal invariance, zero rest–mass fields can be studied on the whole of this conformal manifold. The behavior of the fields on the absolute cone can be used to define the radiation fields. General relativity can be treated from this point of view if the gravitational field is represented by an expression originally equal to the Weyl tensor but which transforms slightly differently under conformal transformation. Author

N66-39278# London Univ. (England). King's Coll.
ASYMPTOTIC PROPERTIES OF FIELDS AND SPACE–TIMES
Roger Penrose *In its* Res. Program in Relativity Phys. Apr. 1966 p 204–212 refs (See N66-39266 24-23) CFSTI: HC $7.80/MF $2.25

A technique for studying asymptotic questions in general relativity is presented. Points at infinity are introduced which constitute a null hypersurface boundary to space–time. This is studied from the point of view of its conformal structure and some new light is shed on the following questions: (1) asymptotic flatness, (2) gravitational radiation fields, (3) peeling off property of the Riemann tensor, (4) total energy-momentum with integral conservation laws, (5) characteristic initial value problem, and (6) Bondi–Metzner–Sachs asymptotic symmetry group. Author

N66-39279# London Univ. (England). King's Coll.
A CLASS OF CONSERVED TENSORS IN AN ARBITRARY GRAVITATIONAL FIELD
C. D. Collinson *In its* Res. Program in Relativity Phys. Apr. 1966 p 222–239 refs Repr. from Proc. Cambridge Phil. Soc., v. 58, pt. 2, 1962 p 346–362 (See N66-39266 24-23) CFSTI: HC $7.80/MF $2.25

Four-index tensors with all possible terms either (a) quadratic in the Riemann curvature tensor, or (b) linear in its second derivatives, with coefficients constructed from products of metric tensors, are enumerated for the case of Riemannian space–time. All linear combinations of these which have zero divergence, and which might therefore be associated with the super-energy in gravitational theory, are found by elementary methods. The only independent such combination reduces in empty space–time to the tensor previously found by Bel and Robinson. Author

N66-39280# London Univ. (England). King's Coll.
GEOMETRICAL AND PHYSICAL INTERPRETATION OF THE WEYL CONFORMAL CURVATURE TENSOR
F. A. E. Pirani and A. Schild *In its* Res. Program in Relativity Phys. Apr. 1966 p 240–247 refs (See N66-39266 24-23) CFSTI: HC $7.80/MF $2.25

A geometrical and physical interpretation of the Weyl tensor in the space–time of general relativity is presented. In the interpretation, the physical components of the Weyl tensor could, in principle, be measured by observations of light rays alone without the use of clocks or rigid rods. The arguments are entirely conformal–invariant; both geometrical and physical interpretations refer not to a particular Riemannian space–time, but to a whole class of space–times which may be obtained from one another by conformal transformations of the metric. M.G.J.

N66-39281# London Univ. (England). King's Coll.
A THEOREM ON PETROV TYPES
J. N. Goldberg and R. K. Sachs *In its* Res. Program in Relativity Phys. Apr. 1966 p 248–258 refs Repr. from Acta Phys. Polon., v. 22, suppl., 1962 p 13–23 (See N66-39266 24-23) CFSTI: HC $7.80/MF $2.25

It is shown that a vacuum metric is algebraically special in the sense of the Petrov classification if and only if it contains a shear-free null geodesic congruence. By noting which field equations are used in the proof of the theorem, the theorem is extended to include an electromagnetic field with geodesic rays as well as a null field. From a theorem of Robinson's on the existence of a null electromagnetic test field, one observes that such a field can be constructed in vacuum if and only if the Riemannian space is algebraically special. From the original theorem, one can easily show that the existence of two independent shear-free null congruences guarantees that the space is Petrov Type I-degenerate. Author

N66-39282# London Univ. (England). King's Coll.
A NOTE ON FERMI COORDINATES
F. A. E. Pirani *In its* Res. Program in Relativity Phys. Apr. 1966 p 267–273 refs Repr. from Proc. Roy. Irish Acad., v. 61, sect. A, no. 2, Dec. 1960 p 8–14 (See N66-39266 24-23) CFSTI: HC $7.80/MF $2.25

Raifeartaigh's condition for the existence of Fermi coordinates on a subspace $U_M (M>1)$ of a Riemann space V_N is applied, somewhat modified, to some general relativity space-times V_4. Author

N66-39283# London Univ. (England). King's Coll.
ON THE CONSISTENCY OF DIRAC'S CANONICAL FORMULATION OF GENERAL RELATIVITY
James L. Anderson *In its* Res. Program in Relativity Phys. Apr. 1966 p 276–287 refs (See N66-39266 24-23) CFSTI: HC $7.80/MF $2.25

Dirac's canonical procedure for dealing with the constraint equations of general relativity is shown to lead to a system of equations which are equivalent to the original Einstein field equations, thus proving its internal consistency. It is further shown that the procedure employed by Arnowitt, Deser and Misner is, with an appropriate choice of the variables to be solved for in the constraint equations, equivalent to the Dirac procedure. Author

N66-39284# Queens Univ., Kingston (Ontario).
COVARIANT ELECTRODYNAMIC POTENTIALS IN DE SITTER SPACE
J. E. Hogarth *In* London Univ. Res. Program in Relativity Phys. Apr. 1966 p 288–314 refs (See N66-39266 24-23) CFSTI: HC $7.80/MF $2.25

A potential distance D is defined by means of which covariant scalar, vector, and tensor potentials may be constructed. A vector potential is defined in de Sitter space whose skew-symmetric derivative satisfies Maxwell's inhomogeneous field equations. A generalization of the gravitational theory of A. N. Whitehead to de Sitter space is discussed. Author

N66-39285# London Univ. (England). King's Coll.
NEWTONIAN MODELS FOR GENERAL RELATIVITY
C. W. Kilmister *In its* Res. Program in Relativity Phys. Apr. 1966 p 315-357 refs (See N66-39266 24-23) CFSTI: HC $7.80/MF $2.25

A theory of gravitation is formulated which includes the principle of equivalence explicitly, but in which the assumption (usually made in general relativity) of the contancy of the velocity of light is replaced by the Newtonian assumption of absolute time. Such a theory is a useful model for some features of general relativity. Author

N66-39286# London Univ. (England). King's Coll.
RIGID MOTION IN A GRAVITATIONAL FIELD
F. A. E. Pirani and Gareth Williams *In its* Res. Program in Relativity Phys. Apr. 1966 p 358-374 refs (See N66-39266 24-23) CFSTI: HC $7.80/MF $2.25

Integrability conditions are constructed for Born's equations of rigid motion in a gravitational field. It is shown that the angular velocity of a rigid test body in vacuo must be of constant magnitude, and a new proof is given for the Herglotz-Noether theorem, which states that in the absence of a gravitational field every rotating rigid motion is isometric. Author

N66-39287# London Univ. (England). King's Coll.
THE INVESTIGATION OF A SET OF WEAKENED FIELD EQUATIONS FOR GENERAL RELATIVITY
A. H. Thompson *In its* Res. Program in Relativity Phys. Apr. 1966 p 389-442 refs (See N66-39266 24-23) CFSTI: HC $7.80/MF $2.25

General relativity is considered with an alternative set of field equations. These equations are weaker than the Einstein equations in the sense that spaces which are interpreted as the gravitational field in vacuo in the orthodox theory form only a subset of such spaces for these field equations. The discussion is confined to the case of the gravitational field in vacuo, but an introduction to the way in which matter is to be represented in the theory is given. Of particular interest are those spaces which are normally interpreted as giving a gravitational field in the presence of matter, but which here appear as the field in vacuo. General methods of constructing such spaces are given, and the metrics discussed on the assumption of particular symmetries. In addition, generalization of such theorems as Brikhoff's, and that of Goldberg and Sachs are proved. Author

N66-39346# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
JOURNAL OF APPLIED MECHANICS AND TECHNICAL PHYSICS Collection of Articles
28 Feb. 1966 326 p refs Transl. into ENGLISH of Zh. Prik. Mekhan. i Tekhn. Fiz. (Moscow), no. 2, Mar.-Apr. 1963 p 1-176
(FTD-MT-64-87; TT-66-62055; AD-637118) CFSTI: HC $7.00/MF $1.50

Articles on magnetohydrodynamics, fluid flow, stress, material properties, explosives, and other aspects of applied mechanics and technical physics are presented. For individual titles see N66-39347-N66-39372.

N66-39397# Naval Research Lab., Washington, D. C.
REPORT OF NRL PROGRESS
Jul. 1966 48 p refs
(PB-170713)

CONTENTS

1. POLARIZED NEUTRON BEAM CHOPPER G. A. Ferguson, Jr. p 1-6 refs (See N66-39398 24-24)
2. MAGNETICALLY FOCUSED IMAGE CONVERTERS WITH INTERNAL REFLECTING OPTICS G. R. Carruthers p 7-13 refs (See N66-39399 24-23)
3. APPLICATIONS RESEARCH P. N. Ziegler et al p 14
4. ELECTRICITY D. S. Toffolo et al p 14-17 refs
5. MECHANICS S. M. Halperson p 17-20 refs
6. METALLURGY AND CERAMICS D. G. Howe et al p 20-30 refs
7. NUCLEAR AND ATOMIC PHYSICS S. G. Gorbics et al p 30-32
8. OPTICAL PHYSICS J. A. Curcio p 32-33
9. RADIO J. A. Vignali et al p 33-34 refs
10. ACOUSTIC BONDING AGENT FOR CRYOGENIC TEMPERATURES G. N. Kamm p 35-36
11. REMOTELY OPERATED SPECIMEN POSITIONING STAGE H. E. Watson p 36-37

N66-39399# Naval Research Lab., Washington, D. C.
MAGNETICALLY FOCUSED IMAGE CONVERTERS WITH INTERNAL REFLECTING OPTICS
G. R. Carruthers *In its* Rept. on NRL Progr. Jul. 1966 p 7-13 refs (See N66-39397 24-23)

A series of magnetically focused image converters, with internal reflecting optics, have been developed for use in far-ultraviolet photography and spectroscopy. The Lallemand (electronographic) method of construction has enabled full advantage to be taken of the very high quantum yields of front-surface alkali-halide photocathodes, without the absorption and short-wavelength cut off limit associated with the use of an end window. It also has made possible the development of an electronographic Schmidt camera. The overall efficiency (product of photocathode efficiency, correct or plate transmission, and mirror reflectance) of the system is at least a factor of 10 higher than similar systems which use photographic film. The elaborate precautions associated with electronography when using visible-sensitive photocathodes are not necessary with the alkali-halide photocathodes. Author

N66-39406*# Chicago Univ., Ill. Dept. of Biophysics.
HIGH RESOLUTION ELECTRON MICROSCOPY WITH SUPERCONDUCTING LENSES AT LIQUID HELIUM TEMPERATURES
Humberto Fernandez-Morán [1966] 20 p refs Submitted for Publication
(Grants NsG-441-63; NIH GM-13243; NIH NB-04267; Contracts AT(30-1)-2278; AT(11-1)-1344)
(NASA-CR-78755) CFSTI: HC $1.00/MF $0.50 CSCL 20F

Results are described which were obtained with different types of cryo-electron microscopes using high-field, niobium-zirconium solenoid lenses with specially designed cryogenic specimen stage assemblies, pole pieces and superconducting regulating circuitry. Exceptional long-term stability and high quality of electron microscopic images directly recorded at 200x to 20,000x were demonstrated under carefully controlled conditions, operating in persistent current mode at 4 to 32 kilogauss and 4 to 40 kilovolts accelerating potential. Electron micrographs of biological specimens were recorded at liquid helium temperatures (4.2°K) with a superconducting Nb-Zr objective lens of special design, reproducibly attaining resolutions of 10Å to 20Å. Preliminary experiments have demonstrated characteristic electron optical phenomena associated with trapped fluxes in thin superconducting films. Author

N66-39407*# Purdue Research Foundation, Lafayette, Ind.
SCHOOL OF AERONAUTICS, ASTRONAUTICS, AND ENGINEERING SCIENCES. TOWED VEHICLE SYSTEMS
Joseph Genin Jul. 1966 31 p refs
(Grant NGR-15-005-021)
(NASA-CR-78754; AA&ES-66-7) CFSTI: HC $2.00/MF $0.50 CSCL 01B

A literature survey made on the topic under consideration is summarized. It was found that most researchers tended to duplicate the works of Glauert. The basic system studied consisted of

a towing vehicle, a cable, and the towed vehicle. The conclusion of the survey is that much work remains to be done, both theoretically and experimentally, before a significantly greater level of understanding than currently exists is achieved in the area of towed vehicles. An annotated bibliography is included. H.S.W.

N66-39408# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NEWS OF INSTITUTIONS OF HIGHER LEARNING—PHYSICS Selected Articles
23 May 1966 20 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zaved., Fiz. (Tomsk), no. 4, 1964 p 72–75; 143–146 (FTD-TT-65-873; TT-66-61946; AD-636660) CFSTI: HC $1.00/MF $0.50

CONTENTS:

1. ON SHOCK WAVES IN METALS L. P. Orlenko and G. F. Yefremov p 1–5 refs (See N66-39409 24-23)
2. ON THE QUESTION OF THE EXCITATION AND DAMPING OF PHOTOCONDUCTIVITY IN MONOCRYSTALS OF AgBr K. N. Loskutov p 6–13 refs (See N66-39410 24-23)

N66-39409# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON SHOCK WAVES IN METALS
L. P. Orlenko and G. F. Yefremov *In its* News of Inst. of Higher Learning—Phys. 23 May 1966 p 1–5 refs (See N66-39408 24-23) CFSTI: HC $1.00/MF $0.50

Discussed are the problems of the damping of shock waves in metals if on the metal surface, dynamic pressure p (t) is applied. A comparison is made of the parameters of shock waves in aluminum and copper, calculated theoretically and obtained experimentally. Author

N66-39410# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE QUESTION OF THE EXCITATION AND DAMPING OF PHOTOCONDUCTIVITY IN MONOCRYSTALS OF AgBr
K. N. Loskutov *In its* News of Inst. of Higher Learning—Phys. 23 May 1966 p 6–13 refs (See N66-39408 24-23) CFSTI: HC $1.00/MF $0.50

A semiquantitative explanation is given of the influence of ultraviolet constant bias lighting on the photoconductivity of crystals of AgBr brought about by interrupted lighting. It was shown that the influence of bias lighting to a substantial extent, depends on the ratio of the intensity of the modulated light to the bias lighting. Author

N66-39450# Polytechnic Inst. of Brooklyn, N. Y. Dept. of Electrophysics.
SCATTERING BY A SINUSOIDALLY-STRATIFIED HALF SPACE
T. Tamir and H. C. Wang Feb. 1966 77 p refs
(Contract AF 19(628)-4324)
(PIBMRI-1314-66; AFCRL-66-139; AD-637450) CFSTI: HC $3.00/MF $0.75

A detailed investigation of the scattering of a plane wave incident on a periodically-stratified medium is presented. The periodic medium occupies the $x > 0$ region, and the stratification occurs along the z direction and is produced by a sinusoidal modulation of the dielectric constant. By choosing the polarization parallel to the y coordinate, the fields in the stratified medium appear as solutions of a wave equation of the Mathieu type. The geometry employed herein is shown to serve as a basic configuration for a large number of applications dealing with optical-acoustic interactions, reflection gratings, periodic antennas and others. The modulated half space therefore represents a canonical problem which leads to rigorous solutions for the present polarization and to good approximations for the alternative polarization. By viewing the solution in terms of waves of the Floquet type, it is shown that the field consists of modes which travel independently and are coupled to each other only at the air-dielectric interface. The coupling mechanism is represented in terms of an equivalent network which lends insight into both qualitative and quantitative aspects of the diffracted field. Graphical constructions using dispersion diagrams are presented which greatly facilitate the understanding and interpretation of various field properties. TAB

N66-39476# Watervliet Arsenal, N. Y. Benet Labs.
ON THE INITIAL CONDITIONS OF THE HYPERVELOCITY IMPACT OF A SPHERICAL PROJECTILE ON A SEMI-INFINITE TARGET
William P. Dunn Jul. 1966 20 p refs
(WVT-6609; AD-637136) CFSTI: HC $1.00/MF $0.50

Based on physical and geometrical considerations, the initial conditions for the problem of a spherical projectile impacting normally on a semi-infinite target are derived. 'Initial conditions', as used here, are implicitly defined as the geometry and 'state' of the projectile and target materials during a time in which uniform compression exists. Results amenable to experimentation are discussed and an example that illustrates a test for the theory is presented. Author (TAB)

N66-39478# Polytechnic Inst. of Brooklyn, Farmingdale, N. Y. Microwave Research Inst.
THE PARAMETRIC COUPLING OF MODES OF PROPAGATION IN NONLINEAR MEDIA
Edward S. Cassedy Jun. 1966 38 p refs
(Contract AF 19(628)-4324)
(PIBMRI-1340-66; AFCRL-66-505; AD-637275) CFSTI: HC $2.00/MF $0.50

Processes of wave propagation may be understood in terms of interactions between waves at different frequencies, such as mixing and harmonic generation. Linearized models of such behavior, useful for studying interactions of two or more small-signal waves in the presence of a high-intensity pumping wave have been studied by this and other authors in the past. The models so treated have dealt with a single mode of propagation. The present work deals with a case of two basic modes of propagation. Results of rigorous analysis demonstrate a pattern of operation which is a generalization of that found for single-mode models. Wave interactions of both the stable and the unstable type are found, in addition to interactions identified with nonlinear shock waves. Shock wave effects are found to be associated with each of the two characteristic velocities of the modes involved. Representative results of dispersion functions and amplitude dependence for partial wave components of the time-space harmonics are also displayed. Author (TAB)

N66-39503# IIT Research Inst., Chicago, Ill. Technology Center.
OPTIMUM MECHANICAL DESIGN SYNTHESIS Final Report, 18 Jun. 1964–18 Jun. 1966
W. D. Pilkey Jun. 1966 126 p refs
(Contract DA-31-124-ARO(D)-243)
(M6089, Vol. I; AROD-4957-6; AD-637599) CFSTI: HC $4.00/MF $0.75

Reported is a new approach to the design of mechanical systems and elements. The classical idea of mechanical design being an iterative trial and error process is replaced by a procedure to first determine the characteristics of the best possible design and then to use this information in the conception of the optimum fabricable mechanical design. Mechanical systems for which the optimum design is distinguished by minimum peak response functions are selected for consideration, with special emphasis on shock isolation and absorption systems. Several techniques, including control theory computational approaches such as dynamic programming, are explored in considerable detail to contribute to

their development or applicability for mechanical design and to determine the promise or difficulties. Description of the techniques appropriate for the new approach are presented. Recommendations are made as to the course ensuing efforts should take. Author

N66-39551# Brown Univ., Providence, R. I.
ON THE INCLUSION OF THE COMPLETE SYMMETRY GROUP IN THE UNIMODULAR GROUP
Morton E. Gurtin and William O. Williams Jun. 1966 26 p refs
(Contract Nonr-562(40))
(TR-16; AD-637520) CFSTI: HC $1.00/MF $0.50

The complete symmetry of a group of a material is usually assumed to consist only of transformations which preserve the density of the material. In this paper it is shown that for a large class of materials this restriction is in fact a consequence of the Clausius-Duhen inequality. It is shown that elastic materials and a particular type of rate dependent materials fall into this class; the proof extends to quasi-elastic materials and quasi-Rivlin-Ericksen materials of all orders. Finally certain restriction which the Clausius-Duhen inequality places on the individual (stress, heat flux, entropy, etc.) Symmetry groups are established for an elastic material Author (TAB)

N66-39559# Brown Univ., Providence, R. I.
THE RELATION BETWEEN DIRECTOR AND MULTIPOLAR THEORIES IN CONTINUUM MECHANICS
Albert E. Green and Ronald S. Rivlin Jul. 1966 23 p refs
(Contract Nonr-562(40))
(TR-17; AD-637521) CFSTI: HC $1.00/MF $0.50

The thermodynamical theory of any number of directors for a continuum with a reference state is re-examined. One form of multipolar displacement theory is shown to be equivalent to a theory of directors. A theory of multiple displacements is considered and is shown to be equivalent to a theory of directors with a constraint. Author (TAB)

N66-39578# Columbia Univ., New York. Dept. of Electrical Engineering.
AXIALLY DEPENDENT PERTURBATION ANALYSIS USING NONLINEAR PHASE PROGRESSION Scientific Report No. 89
Stephen L. Richter, Paul Diament, and S. Perry Schlesinger 15 Dec. 1965 52 p refs
(Contract AF 19(628)-2461)
(CU-17-65-AF-2461-EE; AFCRL-66-205; AD-637712) CFSTI: HC $3.00/MF $0.50

A perturbation technique is developed, valid for arbitrary transverse and axial dependence of a perturbation in an electro-magnetic propagation problem which is otherwise axially unyform. The method, an adaptation and extension of time dependent perturbation theory of quantum mechanics, uses a nonlinear phase progression term in the exponent of the axial dependence of the fields in order to accommodate and readily calculate, without secular terms, corrections to the progressive phase delay through the perturbation. Applicable to problems with hybrid modes, with arbitrary transverse inhomogeneities and anisotropies and with multiple scatterers of essentially arbitrary shape, the method does not depend upon quasistatic or quasi-optic assumptions and is useful for analyzing axially dependent perturbations which give rise to a phase shift, or to radiation, or to any other effect of interest which is strongly dependent upon the phase progression of the perturbed wave. The method is illustrated by a solution of a problem involving an inhomogeneously filled waveguide (i.e., a phase shifter) Author (TAB)

N66-39596# United Aircraft Corporate Systems Center, El Segundo, Calif. Weapons Effects and Support Systems Dept.
THEORETICAL GROUND SHOCK EFFECTS. VOLUME II: APPLICATION OF GENERALIZED COORDINATES TO PLASTIC WAVE PROBLEMS Final Report
John A. Brooks and W. A. Mc Pherson, Jr. Aug. 1966 59 p refs
(Contract DA-49-146-XZ-220)
(SCR-294; DASA-1676-II; AD-637197) CFSTI: HC $3.00/MF $0.75

Two generalized coordinate formulations of the equation of motion and two sets of constitutive relations for the elasto-plastic region surrounding a surface nuclear explosion are presented. The first generalized coordinate formulation is in terms of generalized displacements and has been programmed and tried. It is deficient because of the departure of the solution into the complex domain. The second formulation obviates this deficiency since the inertial terms are linear and the matrix of the highest order derivatives can always be made non-singular by proper choice of basis functions. The first set of constitutive equations is of the Coulomb-limiting shear type with many special cases. The second treatment is simpler as a result of the rounded corners of the yield surface expressed in terms of stress invariants. (Author) TAB

N66-39651# Utah State Univ., Logan. Electro-Dynamics Lab.
WHITE CELLS AS LIGHT GATHERERS Scientific Interim Report
R. O. Waddoups 1 Jan. 1966 41 p refs *Its* Sci. Rept.-3
(Contract AF 19(628)-251)
(AFCRL-66-74; AD-637618) CFSTI: HC $2.00/MF $0.50

The use of White cells (J. V. White, Long optical paths at large aperture, J. Opt. Soc. Am. 32:285 (1942)) as light gatherers is analyzed in this report. Light-gathering efficiency as a function of source position within the cell is determined for a cell of typical dimensions, and is analyzed for cells of general dimensions. Some source locations are found to have high efficiency while others may have low efficiency or even be totally unobservable. It is evident, therefore, that White cells and the sources used with them must be properly designed and applied to be effective Author (TAB)

N66-39667# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BUSHING CAVITATION AND PRESSURE PULSATION IN THE DRAFT TUBE OF A TURBINE
I. V. Kotenev and K. K. Shal'nev 1 Apr. 1966 30 p refs Transl. into ENGLISH from Zh. Prik. Mekhan. i Techn. Fiz. (Moscow), no. 2, 1962 p 59–71
(FTD-MT-65-500; TT-66-62122; AD-637477) CFSTI: HC $2.00/MF $0.50

An investigation was made of the connection of pressure pulsations in the draft tube of a radial-axial turbine with the presence in the tube of bushing cavitation, i.e., cavitation concentrated near the bushing of the runner of a turbine and spreading to the draft tube. TAB

N66-39670# Chalmers Univ. of Technology, Goteborg (Sweden). Research Lab. of Electronics.
WAVE PROPAGATION IN A DISPERSIVE MEDIUM Research Report No. 57
P. R. Mc Isaac 1 Apr. 1966 64 p refs *Its* Tech. Note No. 8
(Contract AF 61(052)-594)
(RADC-TR-66-556; AD-637784) CFSTI: HC $3.00/MF $0.75

The report examines the consequences of temporal and spatial dispersion for the power flow and boundary conditions for electromagnetic wave propagation in dispersive media. The theory is applied to propagation in electron streams and in ferrites Author (TAB)

N66-39704*# Illinois Univ., Urbana. Coordinated Science Lab.
COVARIANT NOETHER IDENTITIES IN COVARIANT FIELD THEORIES

John R. Roy Jul. 1966 17 p refs
(Grant NsG-443; Contract DA-28-043-AMC-00073(E))
(NASA-CR-78874; R-305) CFSTI: HC $1.00/MF $0.50 CSCL 20J

In covariant field theories such as general relativity the application of Noether's theorem results in a set of identities which are satisfied regardless of whether the field equations are satisfied or not (so-called strong conservation laws). In the conventional formulation these identities contain non-tensorial quantities and non-tensorial operations. Thus, for example, the energy-momentum-pseudotensor of general relativity is obtained from such formulations. In this paper the identities arising from Noether's theorem are written in an obviously covariant form containing only tensors and covariant derivatives. As an example we give these identities for general relativity. Author (TAB)

N66-39753# Radiation Research Associates, Inc., Fort Worth, Tex.
GROUND ROUGHNESS CALCULATIONS FOR FALLOUT GAMMA RAYS Final Report
R. L. French and L. Olmedo 30 Jun. 1966 67 p refs
(Contract N228(62479)68174)
(RRA-T61; AD-637427) CFSTI: HC $3.00/MF $0.75

A study was made of four models for calculating the effect of ground roughness on the gamma-ray energy and angular distribution in air above a fallout field. One model, called the buried-source model, assumes that a uniform thin layer of soil covers the fallout with the thickness of the layer corresponding to the degree of ground roughness. Another, called the mixed-source model, assumes that the fallout is mixed with a thin layer of soil. A third model, called the collimated-source model, assumes that the fallout is deposited on a smooth ground surface but that the gamma-ray emission is constrained to certain angular sectors. The last model, called the furrowed-surface model, assumes that the fallout is distributed over a ground surface which has uniform concentric circular furrows. Calculations of the energy and angular distributions of the uncollided and the singly scattered fluxes three feet above sources with one or more energies were performed using each of the models. Comparisons with measured data and consideration of the convenience of application indicate that the buried- and mixed-source models are preferable to the other two. The results indicate that the magnitude and the angular distribution of the uncollided flux is strongly influenced by ground roughness. The singly scattered flux, which can actually be increased by ground roughness, is much less sensitive to ground roughness than is the uncollided flux Author (TAB)

N66-39814# National Aerospace Lab., Tokyo (Japan).
BASIC CONSIDERATIONS FOR TREATING NON-EQUILIBRIUM FLUIDS–A FUNCTIONAL APPROACH TO NON-EQUILIBRIUM STATISTICAL MECHANICS
Iwao Hosokawa Mar. 1966 20 p refs
(NAL-TR-103T) CFSTI: HC $1.00/MF $0.50

A new approach to non-equilibrium statistical mechanics is considered. The essential idea is to solve Bogoliubov's functional-differential equation for the generating functional embracing all distribution functions for our particle system by means of the technique of functional integration. It becomes possible with a minor modification of his formalism. A general solution is given. The solution for the state functional reduces to the Hopf characteristic functional for the Vlasov self-consistent field when the interaction energy of particles is relatively small in each s-body Hamiltonian H_s. Author

N66-39822# Atomic Energy Establishment, Winfrith (England). Control and Instrumentation Div.
A. G. R. STEAM DRUM EXPERIMENT
G. B. Collins 1966 40 p refs
(AEEW-M-634) HMSO: 5s 6d

Steady state and transient measurements made on a forced recirculation boiler steam drum are described, and conclusions are drawn concerning the steady state water subcooling and the dynamic behavior of the water and steam phases during transients. Attempts at parameter identification using a linearized model set up on an analog computer are described, and it is concluded that an asymmetric model is required to adequately describe both increasing and decreasing pressure effects. Further dynamic experiments are suggested using more refined measurement techniques. Author

N66-39892*# Wyle Labs., Inc., Huntsville, Ala.
ACOUSTIC PREDICTION METHODS FOR ROCKET ENGINES, INCLUDING THE EFFECTS OF CLUSTERED ENGINES AND DEFLECTED EXHAUST FLOW
R. C. Potter and M. J. Crocker Washington, NASA, Oct. 1966 refs
(Contract NAS8-11071)
(NASA-CR-566) CFSTI: HC $3.25/MF $1.00 CSCL 20A

Existing methods to predict the noise generated by rocket motors are examined and calculated values compared with measured results. A method of allocating a spectrum of acoustic sources with distance downstream from the nozzle exit is produced. The final result is shown as a single normalized curve, which fits well all the reported results. It is based on measurements of acoustic sound power level on a boundary just outside and at 10 degrees to the rocket exhaust flow. Methods to predict the noise fields generated by clustered rocket engines and deflected rocket exhaust flows are given, based on an analysis of the flow pattern produced. The flow patterns are solved in terms of the rocket flow parameters, nozzle, missle and deflector geometry, and the atmospheric conditions. The prediction method developed in the first part of this report is applied to the various segments of the flows to obtain and resultant noise fields. Comparison of predicted results with experimentally measured values indicates the usefulness of this method, which appears to cover well the whole range of rocket measurements reported. Author

N66-39945# National Bureau of Standards, Washington, D. C.
DIMENSIONAL METROLOGY. SUBJECT-CLASSIFIED WITH ABSTRACTS THROUGH 1964
Irvin H. Fullmer, comp. 1 Aug. 1966 317 p refs *Its* Misc. Publ.-265
GPO: $3.00

This bibliography covers two of the three principal divisions of dimensional metrology, namely (1) linear, angular, and geometrical measurements of solid bodies, and (2) in-process control of sizes. About 3600 references are classified under main subject headings in 12 sections, which are further divided into 102 subsections covering 100 subjects. The 12 main subjects are (1) general metrology, physical and dimensional; (2) length and diameter interferometry; (3) mechanical measurements of length and diameter; (4) length line standards calibration, including tapes; (5) dimensional measuring instrument design; (6) angle measurement; (7) measuring deviations from geometrical regularity; (8) profile measurement; (9) screw and threads measurement; (10) gear measurement; (11) thin film measurement; and (12) measurement and production techniques for accurate in-process control of size and form. The references have abstracts and are arranged chronologically in each subsection. The bibliography is an attempt to organize existing knowledge in this field. Author

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N66-38979# Maryland Univ., College Park. Dept. of Physics and Astronomy.
ON THE OFF-DIAGONAL MASS MATRIX ELEMENT OF THE NEUTRAL K SYSTEM
Ching-Hung Woo Nov. 1965 11 p refs
(Grants AF-AFOSR-500-64; AF-AFOSR-42-64)
(TR-521; AD-634703) CFSTI: HC $1.00/MF $0.50

A recent interference experiment of Fitch et al. has been interpreted as suggesting that the imaginary part of the off-diagonal $K^0-\bar{K}^0$ mass matrix is mainly responsible for the observed cp noninvariance in 2π decay, whereas the imaginary parts of the width matrices are negligible. In this note a study is made of the consistency of such a proposition with simple theoretical models.
Author (TAB)

N66-39072# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON SINGLE-COMPONENT BEAMS OF LIKE-CHARGED PARTICLES
V. A. Syrovoy *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 41–54 refs (See N66-39068 24-23) CFSTI: HC $7.00/MF $1.75

By single-component is understood flow in the direction of the coordinate axes (for instance, in the x^1-direction) of an arbitrary orthogonal system of coordinates $x^i(i=1, 2, 3)$. The question about coordinate systems allowing such flows is investigated. It is shown that in the two-dimensional case, single-component flows are possible only in three orthogonal coordinate systems: Cartesian x, y, polar R, ψ, and helical q_1, q_2. In three-dimensional space there are considered coordinate systems for which

$$g_{11}=h_1(x^1)h_2(x^2)h_3(x^3),\ g_{22}=k(x^2)K(x^1,x^3),\ g_{33}=l(x^3)L(x^1,x^2)$$

Here, to the three cylindrical coordinate systems, corresponding to the shown two-dimensional systems, there are added spherical coordinates r, θ, ψ.
Author

N66-39146# California Univ., Livermore. Lawrence Radiation Lab.
PROCESSING OF COUNTING DATA
P. C. Stevenson Washington, NAS-NRC, May 1966 167 p refs
(Contract W-7405-ENG-48)
(NAS-NS-3109) CFSTI: HC $1.75/MF $1.00

Solutions are presented to problems important to radiochemists who are involved with collection, reduction, and interpretation of data arising from measurements using counting equipment. Information is included on mathematical techniques, statistics of counting data, resolution of decay data, measurement of half-lives, dead time and coincidence considerations, and measurement of absolute counting efficiency.
NSA

N66-39147# Columbia Univ., Irvington, N. Y. Nevis Labs.
LIFETIME OF Σ^* AND THE BRANCHING RATIOS FOR NON-LEPTONIC Σ^+ DECAYS
Chung-Yen Chang (Ph.D. thesis) Feb. 1966 82 p refs
(Contract AT(30-1)-1932)
(R-538; CU-251; NEVIS-145)

Using 9600 charged sigmas produced from $K^- + p \rightarrow \pi + \Sigma$ interactions taking place in a 30-in. hydrogen bubble chamber, the Σ^+ lifetimes and the branching ratios of Σ^+ non-leptonic decays were determined. By means of a least squares fit to the differential decay distributions for the in-flight sigma decays, values were obtained for τ_{Σ^+}, τ_{Σ^-}, B_{Σ^+}, and B_{Σ^+}. Combining the decay rates observed in this experiment with the decay asymmetry parameters found in the past an examination of the validity of the phenomenological selection rule $|\Delta I| = 1/2$ in Σ^+ non-leptonic decays is presented.
Author

N66-39225# Argonne National Lab., Ill.
THE USE OF NUCLEAR NULL-MATRIX IN NEUTRON-DIFFRACTION STUDIES
S. S. Sidhu, Le Roy Heaton, M. H. Mueller, F. P. Campos, K. D. Anderson et al Mar. 1966 25 p refs
(Contract W-31-109-ENG-38)
(ANL-7182) CFSTI: HC $2.00/MF $0.50

Most nuclei scatter thermal neutrons with a 180° phase change, but nine are known to scatter neutrons with a zero-degree phase change. These properties were utilized in preparing a number of nuclear null-matrices that are substitutional solid solutions or stoichiometric alloys of different elements or isotopes of the same element with close-packed hexagonal or face-centered cubic structures. The atomic percentages and the coherent nuclear-scattering amplitudes of the randomly distributed atoms of the matrix are such that the resultant scattering amplitude is zero. Consequently, the structure factor is zero and no diffraction peaks appear in the neutron pattern of the null-matrix. The compounds of the null-matrix material with light atoms, crystallizing in CaF_2-type, NaCl-type, and Mn_4N-type structures, were investigated to determine unambiguously the posotions of light atoms among heavy atoms. The chemical and/or magnetic order-disorder phenomena were studied in both the null-matrix alloys and their compounds.
Author (NSA)

N66-39226# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THEORY AND DESIGN OF LINEAR ACCELERATORS Collection of Articles
28 Feb. 1966 450 p refs Transl. into ENGLISH of the book "Teoriya i Raschet Lineynykh Uskoriteley" Moscow, Gosatomizdat., 1962 p 1–348
(FTD-MT-64-180; TT-66-62041; AD-637068) CFSTI: HC $7.50/MF $2.00

Articles on the dynamics of accelerated particles, different accelerating systems, comparative analysis, and design of most effective systems are presented. For individual titles see N66-39227–N66-39248.

N66-39227# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LINEAR ACCELERATION OF CHARGED PARTICLES
A. I. Akhiyezar and Ya. B. Faynberg *In its* Theory and Design of Linear Accelerators 28 Feb. 1966 p 3–24 (See N66-39226 24-24) CFSTI: HC $7.50/MF $2.00

The history of the development of the linear resonance method for accelerating charged particles is presented, along with a discussion of the advantages, and disadvantages of various linear acceleration systems. Comparisons are made, and means of increasing their effectiveness (such as the use of superconducting materials, type of waveguide, etc.) are considered. At present, a waveguide loaded with metallic disks and working on a $\pi/2$ wave appears to be the most effective accelerating system for linear accelerators of electrons and protons in the high energy region. The mechanism of phase stability in the accelerators; the methods and operating principles of magnetic and grid-focusing; and system design factors in improving accelerator effectiveness, are also discussed.
L.S.

N66-39228# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DYNAMICS OF CHARGED PARTICLES IN A LINEAR ACCELERATOR WITH A TRAVELING WAVE
Ya. B. Faynberg *In its* Theory and Design of Linear Accelerators 28 Feb 1966 p 25–49 refs (See N66-39226 24-24) CFSTI: HC $7.50/MF $2.00

The stability of the radial and phase motions of particles during acceleration in the field of traveling E- and H-waves was investigated. The Lagrange function is used to describe the interaction of an accelerated particle with the electromagnetic wave field, and expressions for components of the electrical and

magnetic fields of the axially symmetric waves are given and used for solving the wave dynamics. The results obtained are valid for both proton and electron acceleration. The wave speed of the particle; the frequency and amplitude of the phase oscillations; and the synchronization of the particles, are considered. L.S.

N66-39229# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

QUESTIONS OF DYNAMICS AND STABILITY OF MOTION OF CHARGED PARTICLES IN A LINEAR ACCELERATOR

A. I. Akhiyezer, G. Ya. Lyubarskiy, and A. E. Pargamannik *In its* Theory and Design of Linear Accelerators 28 Feb. 1966 p 50–101 refs (See N66-39226 24-24) CFSTI: HC $7.50/MF $2.00

A theoretical analysis of the longitudinal and transverse phase oscillations of a beam of charged particles in a linear accelerated field is presented. Equations for perturbed motion are utilized. The influence of the space charge on the motion stability and dynamics is discussed. Other factors discussed include the influence of foils on the scattering (focusing) of the particles, and the focusing of the particle beam by a longitudinal magnetic field or by magnetron lenses. L.S.

N66-39230# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

A SEMI-EMPIRICAL METHOD OF CALCULATING THE ACCELERATING SYSTEM OF A PROTON LINEAR ACCELERATOR WITH A STANDING WAVE

G. Ya. Lyubarskiy, A. M. Nekrashevich, and L. N. Rozentsveyg *In its* Theory and Design of Linear Accelerators 28 Feb. 1966 p 102–117 ref (See N66-39226 24-24) CFSTI: HC $7.50/MF $2.00

A theoretical analysis of the distribution of a particle field in a cavity resonator accelerating system loaded by screen tubes (the dimensions of which monotonically increase with tube number); of the dynamics of the ion beam; and of the motion of the accelerated ions, is presented. The length of the tube used; the speed of the ions; the magnitude of of field strength on the foil; the period of the accelerating system; and the energy and diameter of the ion beam at exit from the accelerator, are all considered. L.S.

N66-39231# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foregin Technology Div.

PHYSICAL BASIS OF THE INJECTOR OF A 10 BEV SYNCHROPHASOTRON

K. D. Sinel'nikov, P. M. Zeydlits, A. M. Nekrashevich, Ya. S. Shuskever, A. I. Akhiyezer et al *In its* Theory and Design of Linear Accelerators 28 Feb. 1966 p 118–137 ref (See N66-39226 24-24) CFSTI: HC $7.50/MF $2.00

Several types of focusing methods, and other factors were considered in designing an accelerator that would be an injector for larger linear accelerators (including a 10 BeV synchrophasotron). The accelerator injector selected was of the resonator type with screen tubes, and works on a standing wave. A grid method of focusing was chosen. Breakdown did not occur during prolonged testing over a period of several days for an average gap intensity of about 140 kv/cm. A parametric analysis, including wave length amplitudes and periods, field strengths, injection and exit energies, beam deflection and energy spectrum, scattering, beam diameter, and other factors was conducted; and calculations are given. L.S.

N66-39232# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foregin Technology Div.

ABOUT POSSIBLE MODIFICATION OF LINEAR AND CIRCULAR METHODS OF ACCELERATION

K. D. Sinel'nikov, Ya. B. Faynberg, and P. M. Zeydlits *In its* Theory and Design of Linear Accelerators 28 Feb. 1966 p 138–144 refs (See N66-39226 24-24) CFSTI: HC $7.50/MF $2.00

An accelerating system which units the advantages of both linear and circular methods of accelerating charged particles is discussed. The system consists of a linear accelerator, bent in an open ring (or along any other curve). The accelerated particles are held on the trajectory of a constant or variable radius with the help of a magnetic field. Radial and axial stability are attained as in circular accelerators of the usual type. The system has the advantages of simplicity of injection and extraction of particles, and the possibility of maintenance by the constants of the generator frequency and magnetic field strength. The design of a curvilinear accelerator is also considered. Calculations concerning the phase stability and radial motion of the accelerator are presented, and discussed. L.S.

N66-39233# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PRELIMINARY GROUPING AND DYNAMICS OF A PROTON BEAM IN A LINEAR ACCLERATOR

A. I. Akhiyezer, G. Ya. Lyubarskiy, L. E. Pargamanik, and Ya. B. Faynberg *In its* Theory and Design of Linear Accelerators 28 Feb. 1966 p 145–166 refs (See N66-39226 24-24) CFSTI: HC $7.50/MF $2.00

Kinematic theory for klystron grouping of particle beams prior to being injected into a linear accelerator is discussed. The influence of space charge on the capture of protons and stability of their motion are calculated. Other variants such as focusing of the magnetic field, beam velocity spread, and energy influences on the acceleration and grouping of the proton particles are also considered. Results of the calculations indicate that it appears to be possible to create a linear accelerator with a small energy of injection ($\approx$0.5 MeV) at large currents ($\approx$10 to 50 ma). The utilization factor of ionic source can be increased several times and brought to about 30% by the use of preliminary klystron grouping. L.S.

N66-39234# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ABOUT FOCUSING BY AN ELECTRON BEAM IN A PROTON ACCELERATOR

A. I. Akhiyezer, G. Ya. Lyubarskiy, and Ya. B. Faynberg *In its* Theory and Design of Linear Accelerators 28 Feb. 1966 p 167–184 refs (See N66-39226 24-24) CFSTI: HC $7.50/MF $2.00

Theoretical calculations concerning a method of focusing in a proton linear accelerator by means of an electron beam passing through the accelerator toward the accelerated proton beam, are developed. Calculations are given for: 1) the motion of the electrons in the accelerator field, 2) the density of current in the injected electron beam, and 3) the scattering of the electron beam in the gas residues within the accelerator. L.S.

N66-39235# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ABOUT PERMISSIBLE OSCILLATIONS OF ACCELERATING FIELD IN A LINEAR ACCELERATION

G. Ya. Lyubarskiy and L. E. Pargamanik *In its* Theory and Design of Linear Accelerators 28 Feb. 1966 p 185–189 ref (See N66-39226 24-24) CFSTI: HC $7.50/MF $2.00

The amount of deflection that can be tolerated in an accelerating field with respect to the stability of motion of the accelerated particles involved, is theoretically studied. The oscillations arise from the power of the feeding generators. Two types of deflection are considered. The first includes those in which the relative magnitude is constant along the whole accelerator. The second type

includes deflections of the accelerating field, the relative magnitude of which changes along the accelerator. Formulas by which the accelerating field can be increased or decreased, thus affecting deflection, are given and discussed. L.S.

N66-39236# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ABOUT OBTAINING AND ACCELERATING MULTIPLY CHARGED IONS IN A LINEAR ACCELERATOR WITH A STANDING WAVE

L. N. Rozentsveyg and G. Ya. Lyubarskiy. *In its* Theory and Design of Linear Accelerators 28 Feb. 1966 p 191–202 refs (See N66-39226 24-24) CFSTI: HC $7.50/MF $2.00

The possibilities of obtaining fast multiple charged ions of light elements (such as C, N, and O) by stripping during passage through a layer of substance in a linear accelerator, are discussed. The ion speed correspondence to average charge is considered. Calculations of optimum stripping cascades are presented and calculations of experimental results pertaining to the recharging of helium ions are discussed. On the basis of the calculations and conditions presented to obtain and accelerate multiple charged ions of carbon, nitrogen, and oxygen to energies of 100–150 MeV, a linear accelerator with a standing wave is suggested. The requirements for the main centers of the accelerator: the high voltage apparatus; the high frequency injector; the stripping chamber; and the basic linear accelerating section, are specified. L.S.

N66-39237# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ABOUT THE POSSIBILITY OF SIMULTANEOUS RADIAL AND PHASE STABILITY IN A LINEAR ACCELERATOR WITHOUT SPECIAL FOCUSING DEVICES

Ya. B. Faynberg. *In its* Theory and Design of Linear Accelerators 28 Feb. 1966 p 203–218 refs (See N66-39226 24-24) CFSTI: HC $7.50/MF $2.00

Equations describing the motion of a particle in an accelerating, axially symmetric, high-frequency electrical field, are presented as part of a theoretical analysis to find a method of focusing using alternate focusing and defocusing lenses for longitudinal phase focusing, so that it will be possible to have simultaneous radial and phase stability without the need for additional devices. L.S.

N66-39238# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON THE POSSIBILITY OF APPLICATION OF LINEAR ACCELERATOR WITH A TRAVELING WAVE FOR ACCELERATION OF HEAVY PARTICLES

N. P. Selivanov and Ya. B. Faynberg. *In its* Theory and Design of Linear Accelerators 28 Feb. 1966 p 219–234 refs (See N66-39226 24-24) CFSTI: HC $7.50/MF $2.00

Specific losses of high frequency power in linear proton accelerator systems with both standing waves and traveling waves, are compared in order to compare the effectiveness of the two systems. A linear accelerator with a standing wave is essentially a resonator, and with a traveling wave is a waveguide in which the phase speed of one of the harmonics of the traveling electromagnetic wave is equal to the speed of the synchronous particle. The approximation methods of Vladimirskiy and of Hansen were used for investigating the waveguide. Curves depicting the dependence of power flux on phase speed, and the dependence of attenuation on phase speed are presented. Results of the calculations indicate that with the existing methods of focusing, an accelerating system of the waveguide type, loaded by disks, is less effective than a resonator, loaded by drift tubes. L.S.

N66-39239# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ABOUT SELECTION OF THE OPTIMUM VARIANT OF A LINEAR PROTON ACCELERATOR

N. P. Selivanov, Ya. B. Faynberg, K. N. Stepanov, and N. A. Khizhnyak. *In its* Theory and Design of Linear Accelerators 28 Feb. 1966 p 235–256 refs (See N66-39226 24-24) CFSTI: HC $7.50/MF $2.00

The properties and operation of various accelerating systems: 1) a resonator with drift tubes, 2) a system of independent resonators with drift tubes, 3) a waveguide loaded by metallic disks with a traveling $\pi/2$ wave, 4) spiral waveguides, 5) a waveguide partially filled by isotropic dielectric, and 6) a waveguide loaded by dielectric disks (equivalent to the waveguide), filled with anisotropic dielectric, are discussed. A theoretical analysis of the propagation of electromagnetic waves in a waveguide loaded by dielectric disks is presented. Calculations are also given for the radial focusing of a beam in a linear accelerator by means of alternate focusing and defocusing lenses with a transverse magnetic field. Other conventional means of focusing (foils and grids; magnetron lenses; use of longitudinal magnetic field; centrifugal; and use of the ϕ component of the magnetic field) are also discussed. L.S.

N66-39241# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INVESTIGATION OF INITIAL PART OF A LINEAR ELECTRONIC ACCELERATOR

Ya. B. Faynberg and N. P. Selivanov. *In its* Theory and Design of Linear Accelerators 28 Feb. 1966 p 266–291 refs (See N66-39226 24-24) CFSTI: HC $7.50/MF $2.00

The dynamics of particles in a linear electron accelerator are theoretically examined. Interaction of the particle with the high frequency electromagnetic field is described by a system of equations. Solutions of equations for various conditions (wave type, amplitude, oscillation, energy boundary of beam, particle speed, and space charge) are presented. Curves depicting the dependence of these factors on the distance of travel, are presented. Also discussed are the influence of the space charge on the phase speed of a beam; and the absorption of energy of the high frequency field by the accelerated beam. The influence of a beam on the electrodynamic properties of the system itself are appraised. Results of calculations of the field cluster, indicate that the intensity of longitudinal and transverse fields of a cluster of particles is significantly less than the corresponding values of the high frequency accelerating field. L.S.

N66-39242# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DESIGN OF A 4 MEV LINEAR ELECTRON ACCELERATOR

N. P. Selivanov, Ya. B. Faynberg, and M. Z. Gil'man. *In its* Theory and Design of Linear Accelerators 28 Feb. 1966 p 292–304 refs (See N66-39226 24-24) CFSTI: HC $7.50/MF $2.00

Calculations for the dispersion of the tangential components of the electrical and magnetic fields for the regions and boundaries of the accelerating system are presented. To determine the magnitude of the electrical field on the axis of the accelerator, the power losses in the first section of the accelerator were calculated from the power flux. The method was applied to calculate the initial section of the linear accelerator to 4 MeV. This section to 0.7 MeV was actually built and successfully tested, and the data permitted a check on the methods and accuracy of calculation. Tables listing the basic geometric parameters of the 0.7 MeV linear accelerator for specified conditions, and of the first section of the proposed 4 MeV linear accelerator are given. Other calculations for use in designing the 4 MeV accelerator are also presented and discussed. L.S.

N66-39243# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

LINEAR ELECTRON ACCELERATOR OF LARGE ENERGIES

A. I. Akhiyezer, Ya. B. Faynberg, N. P. Selivanov, K. N. Stepanov, V. I. Pakhomov et al. *In its* Theory and Design of Linear Accelerators 28 Feb. 1966 p 305–394 refs (See N66-39226 24-24) CFSTI: HC $7.50/MF $2.00

Investigation of radial motion of electrons in a linear accelerator, designed for obtaining of energy of several billion electron-volts in the presence of perturbing magnetic fields shows that combination of a system of compensation for magnetic fields with the help of magnetic fields of a system of rectilinear currents with a small number of correcting electromagnets is expedient. Since length of a linear accelerator is great, a system of additional radial focusing of electrons in the main part of the accelerator is necessary. Focusing in the first section of the accelerator $\epsilon \leq = 30$ Mev and in the injector should be realized with the help of longitudinal magnetic fields. Radial focusing in the main part of the accelerator can be carried out with the help: a) of short magnetic lenses which create a longitudinal magnetic field and b) of a system of quadrupole lenses (strong focusing). Both systems decrease the radius of the beam at the output of the accelerator. Author

N66-39244# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON AUXILIARY FOCUSING OF ELECTRONS BY LONGITUDINAL MAGNETIC FIELD IN LINEAR ACCELERATOR

K. N. Stepanov *In its* Theory and Design of Linear Accelerators 28 Feb. 1966 395–403 ref (See N66-39226 24-24) CFSTI: HC $7.50/MF $2.00

Calculations concerning the transverse motion of electrons in a linear accelerator in the presence of longitudinal focusing coils, are presented. The trajectory of an electron in such a system when there is accurate adjustment of accelerating sections and focusing coils (and in the absence of magnetic stray fields), is determined. Also determined is the amount of additional deflection of the particle from the accelerator axis under the action of forces caused by the presence of magneitc stray fields and random errors in installation of the accelerating sections and focusing coils. Results indicate that for accelerator of great length the accuracy on installation for the focusing coils, should be very high, and that additional focusing in linear accelerators of the magnetic coil type is not expedient. L.S.

N66-39245# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON LIMITING CURRENT IN A LINEAR ELECTRONIC

N. A. Khizhnyak *In its* Theory and Design of Linear Accelerators 28 Feb. 1966 p 404–406 (See N66-39226 24-24) CFSTI: HC $7.50/MF $2.00

The limiting current exerted by accelerating particles on the work of a linear electronic accelerator was determined from the condition in which the synchronous phase falls on the boundary of the region of phase stability. An expression for damping of the field in the accelerator (appearing as a result of energy absorption by the beam and in the walls of the waveguide) was obtained, and the energy conservation law was used. The limiting current expression for the case where the damping expression is disregarded, is also given. L.S.

N66-39246# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CONCERNING THE THEORY OF INTERACTION OF CHARGED PARTICLES WITH BUNDLE OF ELECTRONS IN MAGNETIC FIELD

A. I. Akhiyezer and Ya. B. Faynberg *In its* Theory and Design of Linear Accelerators 28 Feb. 1966 p 407–414 ref (See N66-39226 24-24) CFSTI: HC $7.50/MF $2.00

Maxwell equations and equations of motion of plasma particles which determine the field created by a charged particle interacting with an electron beam are used to evaluate the accelerating fields that occur as a result of the inverse Cerenkov effect and inverse polarization effect losses when a bunch of charged particles is carried along by a beam of electrons moving in a longitudinal magnetic field (as in a linear accelerator). Fourier components of the electrical field are calculated, and expressions for the electrical fields of the system in which the beam lies are derived for several boundary conditions. L.S.

N66-39247# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THEORY OF THE METHOD OF ACCELERATION WITH LIGHT PRESSURE

Ya. B. Faynberg and V. I. Kurilko *In its* Theory and Design of Linear Accelerators 28 Feb. 1966 p 415–423 refs (See N66-39226 24-24) CFSTI: HC $7.50/MF $2.00

Equations of motion for a charged particle in a constant magnetic field under the action of a plane polarized monochromatic electromagnetic wave being propagated along a constant magnetic field (as in a linear accelerator), are used to describe the influence of the radiation pressure on the harmonics of the particle field oscillation. L.S.

N66-39264# Brookhaven National Lab., Upton, N. Y.

SOME MORE TWO-BODY KINEMATICS TABLES

L. B. Leipuner Oct. 1965 719 p
(Contract AT(39-2)-GEN-16)
(BNL-945) CFSTI: HC $10.10/MF $3.00

An updated version of BNL 513 (T-125) is presented. Kinematic tables are presented for antiproton and meson interactions with protons and decays of mesons and hyperons. NSA

N66-39265# Rochester Univ., N. Y. Dept. of Physics and Astronomy.

A MEASUREMENT OF THE LIFETIME OF THE POSITIVE PION

K. F. Kinsey, F. L. Lobkowicz, and M. E. Nordberg, Jr. 1 Dec. 1965 29 p refs Submitted for Publication
(Contract AT(30-1)-875)
(UR-875-112)

Using fast electronic techniques, the $\pi\mu 3$ decay sequence for about 10^8 stopped positive π-mesons was observed. The exponential decay of the π can be followed for 8 means lives, and yields a value of $\tau_{\pi}^{+} = 26.40 \pm 0.07$ nsec. This value disagrees with previously reported values. Author (NSA)

N66-39394*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.

THE EFFECT OF THE LIFETIME OF AN ATOM UNDERGOING A DIPOLE TRANSITION DUE TO THE PRESENCE OF A RESONATING ATOM

Edwin A. Power (Univ. Coll., London) 31 Aug. 1966 12 p
(Grant NsG-275-62)
(NASA-CR-78761; WIS-TCI-186) CFSTI: HC $1.00/MF $0.50 CSCL 20H

The modification of the transition rate from the Einstein A coefficient for an atomic dipole transition due to the presence of a similar atom is obtained without the use of damping theory. Author

N66-39398# Naval Research Lab., Washington, D. C.

POLARIZED NEUTRON BEAM CHOPPER

G. A. Ferguson, Jr. *In its* Rept. on NRL Progr. Jul. 1966 p 1–6 refs (See N66-39397 24-23)

A new technique has been developed for obtaining a chopped beam of polarized neutrons which permits energy analysis. The feasibility of the method has been proven by using neutrons elastically scattered by a single crystal of cobalt. Author

N66-39502# Cambridge Language Research Unit (England).

A CALCULUS FOR A BOOTSTRAP DYNAMICS

Edward W. Bastin. Jan. 1965. 32 p. ref.
(Grant AF-EOAR-65-78)
(AFOSR-66-0415; AD-637560) CFSTI: HC $2.00/MF $0.50

An outline and conceptual basis are presented for a calculus in which the elements are a finite set of similar entities capable of undergoing interactions, and the process of bringing two elements into consideration together constitutes a new element that is of the same kind as the original ones and is capable itself of being brought into consideration with the members of the first set. The elements form a hierarchy and under certain conditions can be simply ordered so that the sets are finite and their order calculable. The simple ordering is used to describe a bootstrap system for interactions between particles and to define the physical quantity of time. A relationship between levels in the hierarchy expresses the recursive nature of each decision by using the total possible number of decisions at each level as the algebraic basis for the set at the next more complex level. The system accounts for dynamic processes in terms of discrete interactions. Its non-formal expression is related to concepts of information transfer. Author (TAB)

N66-39511# Marion (Jerry B.), Silver Spring, Md.
LOW VOLTAGE D-T NEUTRON SOURCE
Jerry B. Marion. Bethesda, Md., Armed Forces Radiobiol. Res. Inst., Jan. 1966. 86 p.
(Contract DA-49-146-XZ-230)
(AFRRI-CR-66-3; AD-637457) CFSTI: HC $3.00/MF $0.75

The report is concerned with an analysis of the problems involved in the design and selection of equipment for the production of intense beams of 14-MeV neutrons. Since the aim is to achieve total neutron yields in excess of 10 to the 13th power/sec, a figure which considerably surpasses that commonly encountered with currently operating accelerators, it is necessary to extrapolate present performance to a considerable degree. Low-voltage accelerators in operation at the present time rarely produce DC beam currents in excess of 1 mA; currents of 600 micro amps. are considered high. The production of neutron yields of 10 to the 13th power/sec will require beam currents greater than 10 mA. This is a significant increase and gives rise to problems of ion source design, source cooling, beam optics, target preparation, mechanical target design, etc. These problems are analyzed individually and certain conclusions are reached and recommendations are made. Author (TAB)

N66-39519# Washington Univ., Seattle. Dept. of Physics.
COLLISION PROCESSES Final Report
Kenneth C. Clark and Ronald Geballe. 19 Jul. 1966. 10 p. refs.
(Contract Nonr-477(32))
(AD-637241) CFSTI: HC $1.00/MF $0.50

A summary is given of studies involving the characteristics of ion-neutral gas collisions in which Lyman-alpha radiation is emitted. A list of publications generated under the contract is included. TAB

N66-39537*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AGES OF PLUTONIUM-BERYLLIUM NEUTRONS IN TUNGSTEN-WATER MEDIA
Donald F. Shook, Roger L. Alexander, Donald Bogart, and Margery Krueger. Washington, NASA, Nov. 1966. 22 p. refs.
(NASA-TN-D-3695) CFSTI: HC $1.00/MF $0.50. CSCL 18H

The spatial distributions of neutrons slowing down from plutonium-beryllium (Pu-Be) sources as indicated by cadmium-covered indium foil activities were measured in water and in mixtures of metallic tungsten rods and water. The effects of the finite sizes of the sources on the shapes of the distributions were experimentally determined. The effects of the heterogeneity and finite size of the slowing-down media were also evaluated. Experimental ages obtained with a 5-curie source corrected to a point source were 50.5±2 square centimeters in water and 46.8±3 and 40.6±3 square centimeters in mixtures of 15 tungsten—85 water and 23.7 tungsten—76.3 water percent by volume, respectively. An age of 53.0±3 square centimeters was determined for a 1-curie Pu-Be source in water. The measurements confirm a reduction in age due to tungsten with its large inelastic scattering cross sections. Calculated and measured ages agreed for water, but the calculated ages were an average of 15 percent lower than the measured ages for the tungsten-water mixtures. Possible reasons for the lower calculated ages are the uncertainties in high-energy tungsten cross sections and the use of the evaporation model to represent inelastic scattering above a neutron energy of 1.8 MeV. Author

N66-39580# Stanford Univ., Calif. High Energy Physics Lab.
A DETERMINATION OF THE TRANSITION WIDTHS OF SOME EXCITED STATES IN ^{12}C
H. L. Crannel, T. A. Griffy, L. R. Suelzle, and M. R. Yearian. Jun. 1966. 16 p. refs. Submitted for Publication.
(Contract Nonr-225(67))
(HEPL-433; AD-637209) CFSTI: HC $1.00/MF $0.50

Previous measurements of the transition probabilities for low energy excitations in Carbon-12, using high energy electron scattering techniques, required considerable extrapolation of the data to obtain the desired results. The paper reports the results of new data obtained at lower values of momentum transferred to the nucleus. Transition widths for the three lowest energy excited states in Carbon-12 were determined using the new data. The results of the experiment allow a much greater confidence in the method employed in this study for determining transition widths. Author (TAB)

N66-39605# Oklahoma Univ. Research Inst., Norman.
TEMPERATURE DEPENDENCE OF HELIUM TRANSFER CROSS SECTIONS Scientific Report, Jan. 1965-Mar. 1966
Robert M. St. John and John D. Jobe. Apr. 1966. 48 p. refs.
(Grant AF-AFOSR-252-65)
(AFOSR-66-1456; AD-637193) CFSTI: HC $2.00/MF $0.50

Helium gas at a pressure of 63 microns and variable temperature has been excited by the impact of 100 eV electrons. At this pressure atomic collisions are plentiful and the excitation energy is thereby transferred from one state to another, primarily from singlet states to singlet and triplet D states. The multiple state transfer process (transfer from N-singlet-P to nF and cascade from nF to lower singlet and triplet D states) is examined in light of the data acquired on the density of singlet P states for n from 3 through 8, singlet D states for n from 4 through 6, and triplet D states for n from 3 through 10. These data were acquired at 8 temperatures in the range from 300 to 1000K. Author (TAB)

N66-39638# Army Engineer Nuclear Cratering Group, Livermore, Calif.
PROJECT PRE-SCHOONER II: CLOUD DEVELOPMENT STUDIES Final Report
Walter C. Day and Robert Rohrer (Calif. Univ., Livermore. Lawrence Radiation Lab.). Jun. 1966. 31 p. refs.
(PNE-511; AD-637746) CFSTI: HC $1.50/MF $0.50

The report presents the cloud development data for the Pre-Schooner II high explosive cratering event conducted in a rhyolite medium in southwestern Idaho. Early base surge radius dimensions are given as a function of time in several directions, and are related to base surge cloud dimensions from past cratering experiments in alluvium and basalt. Measurements of base surge height, main cloud radius, and main cloud height are also given. Two new methods of cloud delineation are described: (1) a laser-radar technique, and (2) a fluorescent particle tracer technique. Author (TAB)

N66-39639# California Univ., Berkeley.
COMPUTER APPLICATION TO THE VISIOPLASTICITY METHOD
A. Shabaik and Shiro Kobayashi Jun. 1966 43 p refs
(Grant Nonr(G)-00020-66)
(AD-637145) CFSTI: HC $2.00/MF $0.50

Procedures for using a computer for the complete solution to plane strain as well as axisymmetric deformation problems have been developed. The velocity, strain rate, total effective strain, and stress distributions were obtained for two commercially pure lead specimens extruded in a forward extrusion process using white lead in oil as a lubricant. The axisymmetric extrusion was carried out at a speed of 1/8 in./min through a conical die having a 45 degrees half cone angle with a 2:1 extrusion ratio, and the plane-strain extrusion through a tapered die having a 45 degrees half taper angle with a 1.66:1 extrusion ratio. (Author) TAB

N66-39669# Oslo Univ., Blindern (Norway). Inst. for Theoretical Physics.
VARIATIONAL METHODS FOR SCATTERING PROBLEMS
Marius Kolsrud 1966 35 p refs *Its* Inst. Rept.-29
(Grant AF-EOAR-64-32)
(AFOSR-66-1014; AD-637700) CFSTI: HC $2.00/MF $0.50

The variational method of Schwinger is extended, and leads to several new stationary expressions for the phase shifts, and for the scattering amplitude. Numerical examples are given Author (TAB)

N66-39672# Stanford Univ., Calif. High Energy Physics Lab.
THE NEUTRON FACTOR
Frank Chilton (Argonne Natl. Lab.) and F. J. Uhrhane Jun. 1966 15 p refs
(Contracts AF 49(638)-1389; Nonr-225(67))
(HEPL-454; AD-637210) CFSTI: HC $1.00/MF $0.50

A functional form for G sub En is found which gives an explanation of why G sub En(t) approx. = 0 but G sub En(0) does not = 0 Author (TAB)

N66-39677# Osterreichische Studiengesellschaft fur Atomenergie G.m.b.H., Seiberscorf (Austria). Physics Inst.
BETA SPECTRUM OF NEUTRON DECAY IN COINCIDENCE WITH RECOIL PROTONS First Annual Summary Report, 1 Feb. 1965–31 Jan. 1966
P. Weinzierl [1966] 43 p refs *Its* Sci. Rept.-1
(Contract AF 61(052)-857)
(AFOSR-66-0833; AD-637480) CFSTI: HC $2.00/MF $0.50

It is shown that a precise measurement of the angular correlation coefficient a yields theoretically important information about weak interactions. Different experimental approaches for the determination of this quantity were studied. The comparison between coincidence measurements and a determination and evaluation of the shape of the proton recoil spectrum led to the decision to choose the latter method. Detailed calculations were carried out on the precision to be expected from different types of proton spectrometers. Finally the following arrangement is chosen and its design discussed: A high vacuum tangential beam tube, accessible at both ends, is well suited as decay proton source for a precisely controlled spectrometry. It is planned to use a spherical condenser spectrometer and a specially developed low background detector for the postaccelerated protons. The beam hole at the opposite side of the reactor will be used for insertion of a test source for simulating decay protons to check the ion optical properties, transmission etc. between and during the spectrum measurements Author (TAB)

N66-39679# Naval Radiological Defense Lab., San Francisco, Calif.
BETA SPECTRA I: FORTRAN PROGRAM FOR COMPOSITE SPECTRA
Ora L. Hogan and Michael A. Hogan 28 Mar. 1966 89 p refs
(Contract AT(49-5)-2505(1))
(USNRDL-TR-1033; AD-637516) CFSTI: HC $3.00/MF $0.75

A FORTRAN II program for IBM 704 was written to compute the beta spectra of fission product mixtures. The computation for individual fission products is based on the Fermi Theory of Beta Decay, with a correction for unique first-forbidden transitions. Output is produced as printed tables. Input data, from which spectra of the individual nuclides may be calculated, are tabulated. Instructions for use of the program are given, and the program itself is listed Author (TAB)

N66-39681# California Univ., Berkeley. Cosmic Ray Group
STUDY OF $\pi^+2\pi^-$ FINAL STATES COHERENTLY PRODUCED ON NUCLEI BY 16 GeV/c π^- Final Technical Report
J. F. Allard, J. Hennessy, R. Huson (Orsay Univ.), A. Lloret (Ecole Polytech., Paris), D. Drijard et al Aug. 1966 25 p refs Submitted for Publication
(Contract Nonr-3656(13))
(ONR-2-1966; AD-637734) CFSTI: HC $1.00/MF $0.50

Coherent production of pi(+) 2pi(-) occurs in approx. 1% of 15 and 16 GeV/c pi(-) C2F5C1 interactions (studied in the Ecole Polytechnique HLBC exposed at the CERN P.S.). For nearly every coherent event, one or both pi(+) pi(-) combinations lies in the rho(o) or f(o). The ratio of pi(-) f(o) to pi(-) rho o coherent production is 0.05 plus or minus 0.02. No N(*) peaks are seen in the coherent events. S-wave pi(-) rho(o) (J(P) = 1(+)) dominates up to at least 1.2 GeV in M pi(-) rho(o) but small admixture of waves of opposite parity is necessary to explain some angular distribution asymmetries. The Dalitz plot excludes dominance of triangle singularity effects. The pi(-) rho(o) mass distribution is dominated by a peak in the A sub 1 region, nearly 250 MeV wide, but too narrow to be explained by the momentum transfer limitation imposed by the nuclear form factor. The calculated OPE (Deck model) and rho exchange M sub pi rho distributions are also too broad to fit out data, but uncertainties in the model preclude its firm rejection. If M sub pi rho distribution is assumed due entirely to resonances, there must be one dominant J(P) = 1(+) resonance near 1.05 GeV. To preserve the A sub 1 with width <150 MeV one must assume two other resonances (approx 940 and approx 1180 MeV) in addition to the A sub 2 (1315) Author (TAB)

N66-39691*# Brown Engineering Co., Inc., Huntsville, Ala. Research Labs.
SPACE RADIATION SHIELDING WITH THE MAGNETIC FIELD OF A CYLINDRICAL SOLENOID
P. F. Mc Donald and T. J. Buntyn Jun. 1966 68 p refs
(Contract NAS8-20166)
(NASA-CR-78934; R-203) CFSTI: HC $3.00/MF $0.50 CSCL 18F

The charged-particle radiation shielding characteristics of magnetic fields generated by right circular solenoids are analyzed using Störmer's theory. Allowed and forbidden regions for unbound particle motion are obtained and shielded volumes are presented in parametric form. The results are applicable over a wide range of particle energies and solenoid parameters through the Störmer transformation. Author

N66-39757# Utah Univ., Salt Lake City. Dept. of Chemical Engineering.
IGNITION AND COMBUSTION OF SOLID PROPELLANTS Technical Report, 1 Oct. 1964–30 Sep. 1965
Jih-Tien Cheng, Larry S. Bouck, John A. Keller, Alva D. Baer, and Norman W. Ryan [1965] 94 p refs
(Grant AF-AFOSR-40-65)
(AFOSR-66-1672; AD-637496) CFSTI: HC $3.00/MF $0.75

A report is given of work in the following areas: ignition theory, ignition of propellants by high convective heat fluxes,

hot-wire ignition, fuel-binder decomposition studies, and propellant extinguishment. TAB

N66-39828# Atomic Energy Establishment, Winfrith (England). General Reactor Physics Div.
A SUGGESTION FOR IMPROVING THE ACCURACY OF ^{240}Pu RESONANCE ESCAPE PROBABILITY MEASUREMENTS USING IRIDIUM FOILS
E. J. Maunders Jun. 1966 16 p refs
(AEEW-M-661) HMSO: 2s 6d

An extension of the Iridium technique for the measurement of ^{240}Pu resonance capture is suggested: in the original method the resonances above 2 eV introduced considerable unwanted contributions to the total reaction rate, which limited the accuracy of the method. This paper suggests a modification of the technique which minimizes these contributions by using the sandwich method with carefully optimized foil thicknesses and a filter of Cd–Ag alloy to eliminate contributions from the 5.36 eV resonance. The results of measurements made using this technique could be analysed without the aid of a digital computer. Author

N66-39830# United Kingdom Atomic Energy Authority, Harwell (England). Information Branch.
FOCUSING OF AN INTENSE ELECTRON BEAM IN AN ACCELERATOR TUBE
I. N. Meshkov and B. V. Chirikov Jan. 1966 21 p refs Transl. into ENGLISH from Russian
(AERE-TRANS-1054) HMSO: 3s

This paper considers the passage of an intense electron beam through a linear accelerator tube. One of the main problems here is the focusing of the beam, i.e. making its cross-section and angular divergence both small. Many publications have been devoted to the problems of focusing electron beams: but so far as we know none has yet considered the dynamics of a relativistic beam in the presence of a longitudinal accelerating field, taking account of the internal field. Author

N66-39859# Westinghouse Electric Corp., Pittsburgh, Pa. Research Labs.
ISOTOPE EFFECT IN THE DISSOCIATIVE ATTACHMENT IN H_2 AT LOW ENERGY
G. J. Schulz and R. K. Asundi 15 Aug. 1966 24 p refs *Its* Sci. Paper 66-9E3-113-P2
(Contract Nonr-2584(00); ARPA Order 125-63; Proj. Defender)
(TR-33; AD-637657) CFSTI: HC $1.00/MF $0.50

The dissociative attachment cross section for formation of H- and D- from H2, HD, and D2 was measured in the threshold range from 3.75 to 5 eV using a mass spectrometer for ion identification. A pronounced isotope effect is observed. The cross section of H- from H2 has a peak value of 1.6 x 10 to the -21 power sq. cm, D- from HD, 1 x 10 to the -22 power sq. cm, and D- from D2, 8 x 10 to the -24 power sq. cm, all peaks occurring at 3.75 eV. Negative ion formation in this energy range proceeds via the compound state, doublet-Sigma + sub u, whose lifetime against autodetachment is calculated from the above cross sections to be about 1 x 10 to the -15 power sec. Because of this short lifetime and the relatively long time needed for the atoms to separate, the probability of survival of the negative ion and therefore the dissociative attachment cross section in H2 at 3.75 eV is small. For the heavier isotopes the separation time is even longer and therefore the dissociative attachment cross section is minute. The same compound state is also responsible for vibrational excitation of the hydrogen molecule. Author (TAB)

N66-39868# Polish Academy of Sciences, Cracow. Inst. of Nuclear Physics.
EQUAL TIME COMMUTATORS AND SCALAR MESONS DECAYS
J. Kwiecinski May 1966 11 p refs
(Rept.-480/PL) CFSTI: HC $1.00/MF $0.50

Some of the applications of the equal time current commutation relations of Gell–Mann are briefly reviewed, and equations are formulated using these relations to estimate the decay rates of scalar mesons decaying into two pseudoscalar ones. It was found, by taking the model literally, that the scalar mesons are rather weakly coupled to pseudoscalar ones, which is in qualitative agreement with bootstrap-like estimates. L.E.W.

N66-39874# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Servizio Documentazione.
EFFECT OF THE COHERENT RADIATION ON THE PHASE DISTRIBUTION OF A RELATIVISTIC BUNCH
E. Ferlenghi 25 Jul. 1966 10 p refs Submitted for Publication *Its* Nota Interna No. 329
(LNF-66/36) CFSTI: HC $1.00/MF $0.50

The particles of a bunch circulating in an accelerator were submitted to a force originating from the coherent radiation. The effect of this force on the particle synchrotron motion was determined from the point of view of the phase distribution function. It is shown that the coherent radiation gives rise to an increase of the longitudinal dimension of the bunch. Author

N66-39932*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A PREFACE TO THE NONADIABETIC THEORY OF ELECTRON–HYDROGEN IONIZATION
A. Temkin 11 Jul. 1966 28 p refs
(NASA-TM-X-55573; X-641-66-311) CFSTI: HC $2.00/MF $0.50 CSCL 20H

The zeroth order problem is shown to give rise to an E2/3 threshold law. The stationary phase result for the asymptotic form of the zeroth order problem is shown to lead to a complete suppression of S-wave ionization events in which the energies of the scattered and ejected electron are equal. Extending the stationary phase results to our conjectured asymptotic form for the complete S-wave problem leads to an even greater suppression in the neighborhood of equal energy events. The combination of such an S-wave cross section together with reasonable higher partial wave cross sections yields a qualitative understanding of experimental ionization energy loss measurements in helium. Author

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N66-39074# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HEAT TRANSFER AND DIFFUSION IN A PARTIALLY IONIZED TWO-TEMPERATURE PLASMA
G. S. Bisnovatyy-Kogan *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 73–85 refs (See N66-39068 24-23) CFSTI: HC $7.00/MF $1.75

There is given a solution of the Boltzmann system of equations for plasma in a magnetic field by the Chapman–Enskog method. The plasma is considered partially ionized, and the temperature of electrons can differ from the temperature of heavy particles. Tensors are obtained, connecting the thermal fluxes and the diffusion velocities with temperature gradients and diffusion vectors. Author

N66-39075# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON REGIONS OF APPLICABILITY OF VARIOUS EQUATIONS FOR STUDY OF COMPLETELY IONIZED GAS

V. B. Baranov *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 86–98 refs Presented at 2d All-Union Conf. on Theoret. and Appl. Mech., Moscow, Jan. 1964 (See N66-39068 24-23) CFSTI: HC $7.00/MF $1.75

In the method proposed, the necessary limitations for plasma parameters are extracted so that, by means of averaging, one can pass from Liouville's equation for the random function of the number of particles to the kinetic Boltzmann equation with the integral of collisions in the Landau form. Based on the obtained system of inequalities in the density–temperature plane, a diagram of regions is constructed. This graphically presents the possibility of using one or another equation for describing plasma processes if such parameters as ionization potential of the gas, density, temperature, and magnetic field are known. M.G.J.

N66-39076# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE ELECTRICAL FIELD IN A MAGNETOHYDRODYNAMIC CHANNEL OF RECTANGULAR SECTION WITH NONCONDUCTING WALLS

S. A. Regirer *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 99–111 refs (See N66-39068 24-23) CFSTI: HC $7.00/MF $1.75

A complete solution is presented for the three-dimensional problem of distribution of currents in a channel of rectangular section with nonconducting walls, valid for any given dependence of vectors of velocity and the magnetic field on coordinates. There is also investigated a solution, corresponding to the particular case of rectilinear flow in a nonuniform transverse field. In conclusion there are discussed conditions which should be satisfied, in general, by the magnetic field assigned in the solution. Author

N66-39093# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EVOLUTION OF A WAVE PACKET IN HYDRODYNAMICS WITH DISPERSION OF SOUND

V. Ye. Zakharov *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 296–301 refs (See N66-39068 24-23) CFSTI: HC $7.00/MF $1.75

Questions concerning the evolution of an arbitrary wave packet are posed, in relation to the concept that if the amplitude of the packet is sufficiently small the influence of nonlinear terms can be disregarded, and its evolution described by propagation resulting from dispersion. A simple one-dimensional hydrodynamic model of ion sound is considered, in which the plasma is described by velocity and density of the ions, and by the electrostatic potential. A system of equations is derived to show that such a concept is valid only for very severe limitations on the shape of the packet. It is also shown that for the general case the influence of nonlinearity should be taken into account for even the smallest packet amplitude. M.G.J.

N66-39248# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SOME QUESTIONS OF ACCELERATION OF PARTICLES IN PLASMA

Ya. B. Faynberg *In its* Theory and Design of Linear Accelerators 28 Feb. 1966 p 424–443 refs (See N66-39226 24-24) CFSTI: HC $7.50/MF $2.00

Various factors affecting the acceleration of charged particles along plasma beams between electromagnetic forces (as in a linear accelerator) are discussed. The focusing capabilities of various types of waveguides; the current density; field energy density; bunching effects; radial and phase stability; phase oscillation frequency and amplitude; and other influences affecting the dynamics of the accelerated charged particle are discussed. L.S.

N66-39333*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.

SIMPLIFIED MODEL OF SEGMENTED ELECTRODE LOSSES IN NONEQUILIBRIUM MHD GENERATORS

Myron A. Hoffman Aug. 1966 31 p refs

(Grant NsG-496)

(NASA-CR-78750; CSR-TR-66-7) CFSTI: HC $2.00/MF $0.50 CSCL 20I

Linear, segmented electrode MHD generators designed to utilize nonequilibrium ionization have not yet produced the expected performance. Kerrebrock proposed that this could be due to shorting of the Hall current along the electrode wall. A simplified two-layer model of these important generator nonuniformities is proposed in this paper. Solutions of the resulting set of algebraic equations exhibit the same essential behavior as Kerrebrock's more complete theoretical formulation. In particular, the equations yield the "normal" and the "shorted" modes found by Kerrebrock and permit the calculation of the stability boundary between these modes. Author

N66-39348# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CYLINDRICAL ARC IN ARGON

G. Yu. Dautov *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 36–53 refs (See N66-39346 24-23) CFSTI: HC $7.00/MF $1.50

Consideration is given to some general properties of a cylindrical electric arc. Conditions are derived for the comparative parameters of various arcs having a small degree of gas ionization, and results are given of computer calculations for an arc in argon. It is concluded that criteria for the comparative parameters allows a qualitative estimate of the influence of gas, pressure, radius, and electric field strength on the behavior of the arc. C.T.C.

N66-39349# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CERTAIN TWO-DIMENSIONAL PROBLEMS OF CURRENT DISTRIBUTION IN A CONDUCTING MEDIUM, MOVING ALONG A CHANNEL IN A MAGNETIC FIELD

A. B. Vatazhin *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 54–82 refs (See N66-39346 24-23) CFSTI: HC $7.00/MF $1.50

A method for solving the problem of current distribution in a channel with dielectric walls and an arbitrary velocity profile is presented. Arbitrary dependencies of electrical conductivity and a magnetic field on the longitudinal coordinate are assumed. Consideration is given to a case in which there are two finite dielectric wall sections when the magnetic field and electrical conductivity in the channel are constant. Also considered is a case in which the electrical conductivity is different from zero only in the electrode zone. C.T.C.

N66-39350# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PROPAGATION OF THE INITIAL PULSE IN MAGNETOHYDRODYNAMICS WITH ARBITRARY CONDUCTIVITY

G. S. Golitsyn *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 83–98 refs (See N66-39346 24-23) CFSTI: HC $7.00/MF $1.50

Spatial harmonics is utilized in solving a problem concerned with the propagation of a small initial perturbation in a medium possessing arbitrary conductivity and located in a uniform magnetic field. The perturbation is composed of a set of waves with different lengths, with each propagating at its own velocity and attenuated by its own law. The solution shows that the perturbation turns into a series of single waves, moving at a speed of low frequency oscillations. C.T.C.

N66-39351# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXACT SOLUTIONS OF CERTAIN PROBLEMS OF MAGNETOHYDRODYNAMICS
G. I. Nazarov *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 99–115 refs (See N66-39346 24-23) CFSTI: HC $7.00/MF $1.50

A modified Bergmann method is used in finding exact solutions of equations describing the potential motion of a gas in a magnetic field. This magnetic field is considered perpendicular to the plane of flow and has an infinite conductivity. Solutions are found for the stream function in variables of the hodograph of velocity for subsonic and supersonic motion (adiabatic process). Problems of gas stream collisions in a magnetic field and the flow of gas out of a vessel with a nozzle are also solved. C.T.C.

N66-39352# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CERTAIN SOLUTIONS OF EQUATIONS OF STEADY FLOW OF AN INCOMPRESSIBLE VISCOUS AND CONDUCTING FIELD
A. Ye. Yakubenko *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 116–126 refs (See N66-39346 24-23) CFSTI: HC $7.00/MF $1.50

Solutions are presented for two problems involving the flow of a viscous, conducting fluid in a magnetic field. In the first, consideration is given to the flow of a conducting fluid in a pipe of elliptic section. In the second problem consideration is given to the motion of an elliptic bar and a plate of finite width in a fluid filling an entire space. The derivation of a formula for the resistance to motion of a plate for any Hartmann number is included. C.T.C.

N66-39353# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY OF THE KINETIC EQUATION OF A SYSTEM OF CHARGED PARTICLES IN THE CASE OF RARE COLLISIONS
A. N. Dyukalov *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 127–137 refs (See N66-39346 24-23) CFSTI: HC $7.00/MF $1.50

An investigation is presented of a kinetic equation which represents a system of charged particles. This equation incorporates a binary distribution function and the potential of a self-consistent field. Consideration is given to the possibility of the existence of discontinuous solutions, and studies are presented of the particle flux through the surfaces of discontinuities. The establishment of boundary conditions for the distribution function of finite particles is included. C.T.C.

N66-39365# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE LAMINAR FRONTIER LAYER IN A SOLUTION OF ELECTROLYTE WITH CROSSED MAGNETIC AND ELECTRICAL FIELDS
I. B. Chekmarev and Hsing-Mo Chang *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 259–264 refs (See N66-39346 24-23) CFSTI: HC $7.00/MF $1.50

Consideration is given to a flat laminar boundary layer in a semi-infinite plate, past which there flows a flux of incompressible fluid with a given velocity. The problem is limited to the case of low concentrations, when the density and viscosity of the liquid can be considered constant, and electrical conductivity can be considered a linear function of the concentration. Solutions are obtained by using known assumptions of the boundary layer theory and by application of the method of successive approximations. A.G.O.

N66-39505# London Univ. (England). Queen Mary Coll.
CHAPMAN-FERRARO HOLLOWS FOR A SYSTEM OF LINE CURRENTS ENVELOPED BY A STRATIFIED CORPUSCULAR FLUX Scientific Report No. 6
R. C. Hewson-Browne and D. W. Windle [1964] 31 p refs Submitted for Publication
(Contract AF-EOAR-64-74)
(AFCRL-66-584; AD-637178) CFSTI: HC$2.00/MF$0.50

A stratified plasma stream of infinite conductivity is incident on the magnetic field of a system of parallel line currents. The magnetic field is confined to a hollow within the stream and the plasma particles are assumed to be specularly reflected at the hollow surface. A boundary condition which also serves as the hypersonic shockwave approximation. The method of solution is illustrated by considering the case of a stream comprising a number of uniform layers. In particular, the case of a single line current only partially enveloped by a uniform stream and the case of a two-layered stream past a line dipole are considered. Author (TAB)

N66-39554# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A PROBLEM OF ELECTRODYNAMICS
K. I. Kim 8 Apr. 1966 9 p ref Transl. into ENGLISH from Dopovidi Akad. Nauk Ukr. RSR (Kiev), no. 10, 1964 p 1326–1330 (FTD-TT-65-1768; TT-66-62096; AD-637418) CFSTI: HC $1.00/MF $0.50

The construction of the lateral walls of a channel, using conductivity material, is an effective measure for restricting Hall effects in a liquid moving in a traveling magnetic field. The algorithm for computation of a stationary electromagnetic process in a liquid is indicated for the given case Author (TAB)

N66-39563# Rydbeck Research Associates, Fjaras (Sweden).
REFLECTION AND AMPLIFICATION OF ELECTROMAGNETIC WAVES IN AN OSCILLATING IONIZED MEDIUM, PART I Scientific Report No. 4
J. Askne 15 Jun. 1966 51 p refs
(Contract AF 61(052)-864)
(AFCRL-66-595; AD-637664) CFSTI: HC $3.00/MF $0.50

Electromagnetic waves propagating in a semi-infinite ionized medium with the density varying periodically in time and space due to a progressive high power pump wave or some type of longitudinal wave are considered. The instability conditions are considered and it is found that the dispersive medium yields possibilities of traveling wave parametric amplification. All harmonics are taken into account as well as higher orders of self-consistent modes. The dispersion diagram is studied by means of coupled mode analysis and the interaction conditions are determined and analyzed to first order. The analysis is compared with a Mathieu-type analysis. Expressions for the reflection coefficients are given, and possibilities to obtain the different kinds of interaction discussed. Author (TAB)

N66-39641# Columbia Univ., N.Y. Dept. of Electrical Engineering.
CYCLOTRON HARMONIC RADIATION FROM ELECTRON BEAM INJECTION INTO AN AFTERGLOW PLASMA Scientific Report No. 86
Thomas C. Marshall, Phillips Bradford, and S. Perry Schlesinger Jan. 1966 34 p refs
(Contract AF 19(628)-2461)
(CU-18-65-AF-2461-EE; AFCRL-66-204; AD-637710) CFSTI: HC $2.00/MF $0.50

A pulsed electron beam was injected into an afterglow produced by a P.I.G. discharge in low pressure argon. The beam and the afterglow form concentric posts in X-band waveguide on which accurate microwave measurements were made. Radiation at the cyclotron harmonics was observed from the simultaneous beam and afterglow plasmas when the beam was too low to generate its own radiating plasma. Radiation was enhanced when the experimental parameters were consistent with the Bernstein electrostatic dispersion relations. Observations of the width of the third harmonic radiation resonance as the plasma frequency was

varied are in qualitative agreement with the theory of Auer and Stone. Space charge fluctuations at the receiver frequency (9.2 Gc) were also observed when the radiation occurred Author (TAB)

N66-39661# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
THEORY OF SPHERICAL PROBES IN MONOENERGETIC PLASMAS
Karl G. Guderley and Emma Marian Valentine Feb. 1966 155 p refs
(ARL-66-0024; AD-637513) CFSTI: HC $5.00/MF $1.00

The paper gives a survey of the behavior of a plasma probe in a monoenergetic isotropic homogeneous plasma. (Monoenergetic means that all electrons have the same energy, the energies of the electrons and ions may be different). The analysis is carried out in the Vlasov approximation. It begins with the derivation and a discussion of the equation for the potential in the field around the functions are specialized to delta-functions. The governing equation is a non-linear differential equation containing parameters which are ultimately defined by the solution which one wants to find. This solution is found iteratively. In order to obtain the p(th) approximation a linearization for the vicinity of the (p-1)th approximation is used. A special technique is used in order to obtain a formulation which is numerically stable. On this basis probe characteristics (probe current versus probe potential) were computed for a considerable number of cases, so that a fairly complete survey of the behavior of a probe is obtained Author (TAB)

N66-39684# Innsbruck Univ. (Austria). Inst. for Theoretical Physics.
THE ONE-DIMENSIONAL UNSTEADY DIFFERENTIAL EQUATION OF THE MGD POTENTIAL FLOW AS A VARIATIONAL PROBLEM Scientific Report No. 32
Franz Herrnegger 10 Mar. 1966 13 p refs
(Contract AF 61(052)-675)
(AFOSR-66-1752; AD-637724) CFSTI: HC $1.00/MF $0.50

A method is given which allows to determine an approximate closed solution of a certain non-linear second order differential equation. The method is suited for treating non-linear (propagation of a finite pressure jump) and nonseparable problems. A variational functional to the one-dimensional unsteady potential equation of the ideal MGD (magneto gas dynamics) was given for general values of mu, as a function of the local velocity of sound. This functional was expressed as a function of the velocity potential phi for the mu-values 3/2 and 2. The variation-integral was evaluated numerically by means of the Ritz method. A modified Kantorovitsch method can be applied in order to obtain higher accuracy since this method allows to determine a continuous function instead of discrete constants c sub mu nu. The numerical labor is rather less with this method. There are, however, no results on this method Author (TAB)

N66-39724*# Northwestern Univ., Evanston, Ill. Gas Dynamics Lab.
THEORETICAL ASPECTS OF BLUNT BODY MAGNETOAERODYNAMICS
Robert W. Porter and Ali Bulent Cambel Aug. 1966 220 p refs
(Grant NsG-547)
(NASA-CR-78945) CFSTI: HC $6.00/MF $1.25 CSCL 20I

Theoretical aspects of supersonic magnetoaerodynamic flow about a blunt body with self contained magnetic field source are presented. The effect was studied for a hemisphere nose containing a dipole field source with body and magnetic axis at zero angle-of-attack. Theoretical predictions of the alteration of magnetoaerodynamic coefficients and of the flow field are presented for a range of parameters appropriate for possible application to planetary entry flight control and laboratory simulation. After a general introduction to flight magnetohydrodynamics and appropriate literature survey, flight and laboratory regimes were delineated and compared. A mathematical model for constant property flow was developed and the equations were non-dimensionalized in terms of parameter groups. The equations were reduced for the stagnation region where the principal effect and local similarity occur. It was found that the shock density ratio and magnetic interaction parameter are of principal importance. Viscous effects are also important for low density laboratory flows. Author

N66-39729# California Inst. of Tech., Pasadena.
INCOHERENT RADIATION PROCESSES IN PLASMAS
Fred L. Hinton Aug. 1966 60 p refs
(Contract AF 49(638)-1462)
(TR-4; AD-637587) CFSTI: HC $3.00/MF $0.75

The power spectrum of the microscopic density fluctuations in a plasma is calculated using an approximate solution of the N-particle problem. This solution makes use of the assumption that the particle trajectories, in a homogeneous plasma with many particles per Debye sphere, are nearly straight lines for large time intervals, and particle interactions can be treated as small perturbations. The general problem of radiation in such a plasma is formulated in terms of a wave equation which describes the refractive index property of the plasma, and whose source term is a sum of terms responsible for the absorption and the scattering of microscopic wave, and for bremsstrahlung. The spectral flux density and emissivity for the scattered radiation and the bremsstrahlung are related to the power spectra of the microscopic density fluctuations. The source term responsible for absorption is calculated, using a generalization of the solution of the N-particle problem. The purpose of the paper is to clarify the physics of the various processes considered by deriving them from basic principles, and not using the formalism of Plasma Kinetic Theory Author (TAB)

N66-39749# Columbia Univ., New York. Dept. of Electrical Engineering.
ELECTROMAGNETIC–ACOUSTIC WAVE PROPAGATION ALONG WARM PLASMA COLUMNS Scientific Report No. 88
Paul Diament, V. L. Granatstein and S. P. Schlesinger Dec. 1965 50 p refs
(Contract AF 19(628)-2461)
(CU-19-65-AF-2461-EE; AFCRL-66-161; AD-637711) CFSTI: HC $2.00/MF $0.50

Dispersion relations for waves propagating along homogeneous, isotropic, warm plasma columns surrounded by a dielectric medium are obtained. A steady state, linearized model with temperature introduced through a scalar pressure is analyzed both quasistatically and more rigorously from Maxwells equations. The results show effects of temperature on the cold-plasma surface wave and predict a new series of propagating modes above the plasma frequency, related to the Tonks-Dattner scattering resonances near cutoff and to the Bohm-Gross longitudinal plasma waves for large wave numbers. Warm and cold plasmas, large and small columns, and quasistatic and rigorous predictions are contrasted. Regions of the Brillouin diagram corresponding to different bound and radiating wave types are delineated and related to their physical properties Author (TAB)

N66-39755# Royal Inst. of Tech., Stockholm (Sweden). Microwave Dept.
EXPERIMENTS ON ION-ACOUSTIC WAVES Scientific Report No. 6, 1 Jun. 1965–1 May 1966
P. O. Nilsson 1 May 1966 61 p refs
(Contract AF 61(052)-895)
(RADC-TR-66-499; AD-637229) CFSTI: HC $3.00/MF $0.75

Propagation of ion-acoustic waves has been studied experimentally in a low pressure mercury discharge. Both self-excited and externally excited waves were observed in the frequency range 40 - 130 kHz. No static magnetic field was applied. The influence of the neutral gas pressure, electron density, discharge current, and tube diameter on the properties of the ion waves was examined. Different types of exciters were used. An experimental dispersion curve is compared with theoretical results. It is shown that at some values of the steadystate parameters the ion waves propagate completely undamped along the whole plasma column. Finally a comparison is made between the noise frequency spectrum and the frequency dependence of the ion waves Author (TAB)

N66-39766# Brown Univ., Providence, R. I. Div. of Engineering.
EXPERIMENTS ON JOULE HEATING OF SHOCK-IONIZED AIR
Suha Selamoglu Mar. 1966 30 p refs
(Contract AF 49(638)-1295)
(WR-45; AFOSR-66-0886; AD-637502) CFSTI: HC $2.00/MF $0.50

The heating of ionized air by means of low voltage d.c. discharge between cold, plane electrodes is controlled primarily by the thermal boundary layers adjacent to the electrodes. In shock-ionized air at 6700-7800K and 10-20 atm three characteristic domains of discharge intensity are estimated experimentally. Below 1 kW/sq cm the thermal boundary layer thickness is nondecreasing in time. Between 1 and 100 kW/sq cm the thickness decreases with no significant heating effect in the outer region within a practically short time. Above 100 kW/sq cm boundary layer shrinks very rapidly, an immediate heating of the free gas follows. The total Joule heat rate in the outer region becomes comparable with that in the boundary layer only in the strong discharges where the current density is of the order of 1000 A/sq cm Author (TAB)

N66-39776# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MANY-PARTICLE ASPECTS OF THE THEORY OF TURBULENT PLASMA
A. A. Galeyev, V. I. Karpman, and R. Z. Sagdeyev 21 Mar. 1966 68 p refs Transl. into ENGLISH from Russian
(FTD-TT-65-1891; TT-66-62099; AD-637421) CFSTI: HC $3.00/MF $0.75

The survey is devoted to an investigation of the weakly turbulent state of a rarefied plasma, when one can assume a weakly interacting gas of collective oscillations, quasi-particles, on a background of the average distribution of plasma particles. By describing the behavior of a rarefied plasma with the aid of the kinetic Boltzmann equations for the particle distribution functions and the Maxwellian equations for the self-consistant electrical and magnetic fields and by using the perturbation theory for a small ratio of the energy of interaction of collective oscillations among themselves and the background to their full energy, in this case kinetic equations for the number of quasi-particles are obtained. Representing the collective oscillations in the form of separate quanta permits the expression of a number of properties of their nonlinear interaction in the simplest form. The quasi-linear theory is used to describe the interaction of oscillations with the background. The application of the obtained equations is then illustrated on a series of specific examples Author (TAB)

N66-39781# Innsbruck Univ. (Austria). Inst. for Theoretical Physics.
THE MAGNETIC LAVAL NOZZLE
Franz Hermogger 24 May 1966 15 p refs *Its* Sci. Rept.-34
(Contract AF 61(052)-675)
(AFOSR-66-1757; AD-637741) CFSTI: HC $1.00/MF $0.50

A review is presented of a number of papers examining the flow conditions in a magnetic laval nozzle. The author writes the general equations describing the system and discusses the assumptions made by the various investigators. Among the most important are the assumptions for linearization and the value of the various non-dimensional parameters. A literature survey is given concerning the channeling effect of a magnetic field in a plasma with infinite and finite electrical conductivity Author (TAB)

N66-39836# Kyoto Univ. (Japan). Dept. of Aeronautical Engineering.
ELECTRONIC EXCITATION TEMPERATURE MEASUREMENTS OF ARGON PLASMA JET
Goro Kamimoto, Yasuo Watanabe, and Hiroyuki Shirai Dec. 1965 29 p refs
(CP-9) CFSTI: HC $2.00/MF $0.50

Spectroscopic measurements of the electronic excitation temperature have been performed in the arc-heated argon plasma-jet. Measured free stream temperatures at the exit of a supersonic convergent-divergent nozzle ranged from 3,700°K to 4,000°K, and no remarkable change could be observed for a threefold increase in power input to the electrodes at the gas flow rates used in the experiments. Stagnation temperatures were also measured and found to range from 4,000°K to 4,500°K. Comments on the outstanding features of the results are given. Author

N66-39877# National Aerospace Lab., Tokyo (Japan).
IONIZED FLOW IN A CONICAL SHOCK TUBE
Riichi Matsuzaki 1966 21 p refs In JAPANESE, ENGLISH summary
(NAL-TR-107) CFSTI: HC $1.00/MF $0.50

Ionized flow is investigated using an electric shock tube with a conical driver section. Observed velocities of luminous fronts in the tube are proportional to a parameter $V_0/\sqrt{P_1}$, where V_0 is the charging voltage and P_1 is the initial pressure. The result agrees quantitatively with the ordinary shock tube theory with assumptions that the driver gas is heated by discharge current in the driver section of constant volume, and that the specific-heat ratio has the value of real gas. Precursor phenomena ahead of the fronts were observed. Results of double probe measurement show that the flow consists of uniform and trailing regions. The ionized flow established in the tube is described by one-dimensional ionized flow analysis, and reasonable explanations are made on the flow profile in the trailing region and on the effect of ion-electron recombination on the peak values of the probe signals. Author

N66-39879# Atomic Energy Establishment, Winfrith (England). Technical Assessments and Services Div.
CLOSED CYCLE NUCLEAR M.H.D. STUDIES USING DUST SUSPENSIONS
A. T. Hooper, D. Newby, and A. H. Russell May 1966 15 p refs
(AEEW-M-659)

A light suspension of barium oxide in argon gas was investigated as a working fluid in a closed cycle nuclear magneto hydrodynamic (MHD) plant. The electrical conductivity of the working fluid was calculated for a range of loadings, temperatures, and pressures. Curves are presented showing that the conductivity temperature curve for low pressure lies below the curve for high pressure at the high end of the temperature scale but rises above it at low temperature. The main difficulty in evaluating the overall cycle efficiency lies in ascribing a value to the pressure drop across the MHD duct. A general expression was derived incorporating the duct design variables into a single multiplier of the temperature ratio in the usual adiabatic expression. By means of the calculus

of variations optimization of duct power density was carried out for the duct as a whole. Using this general expression, overall performance curves are presented relating temperature ratios, cycle efficiency and compressor power demand for various values of the temperature ratio multiplier. These curves can be generally applied for any working fluid, since the properties of the working fluid only enter into the selection of the appropriate multiplier value. An energy flow diagram is presented showing the sizes of components in a chosen cycle. Author

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N66-39345*# Stanford Univ., Calif. Microwave Lab.
EXCHANGE-COUPLED CHROMIUM IO^{+1} PAIRS IN RUBY
L. F. Mollenauer May 1965 153 p refs
(Grant NsG-331)
(NASA-CR-78596; ML-1325) CFSTI: HC $5.00/MF $1.00 CSCL 20L

The measurement of the exchange coupling between the various near neighbor types of Cr^{3+} ion pairs in the antiferromagnetic compound Cr_2O_3 is reported. A Hamiltonian expression is presented for the exchange coupling. The sharp line fluorescence spectrum of the dark ruby lattice containing near neighbor Cr ion pairs is investigated. At low temperatures, this spectrum consists of a quartet of lines for each pair type whose spacings yield a very accurate measure of the exchange integral of the nearest neighbors. The various and sometimes overlapping exchange multiplets are separated and identified with a particular near neighbor type. Only the first four nearest neighbor types were found to have significantly large exchange interaction. An application to laser technology is included. R.LI.

N66-39419 Massachusetts Inst. of Tech., Cambridge.
SOLID-STATE AND MOLECULAR THEORY GROUP Quarterly Progress Report No. 61
15 Jul. 1966 154 p refs
(Contract Nonr-1841(34); Grants NSF G-24908; NSF GP-3241)
(AD-636479) CFSTI: HC $6.00/MF $1.50

CONTENTS:
1. THE CURRENT STATE OF SOLID-STATE AND MOLECULAR THEORY J. C. Slater p 193-272 refs (See N66-39420 24-26)

N66-39420 Massachusetts Inst. of Tech., Cambridge.
THE CURRENT STATE OF SOLID-STATE AND MOLECULAR THEORY
J. C. Slater *In its* Solid-State and Mol. Theory Group 15 Jul. 1966 p 193-272 refs (See N66-39419 24-26) CFSTI: HC $6.00/MF $1.50

The development of present concepts of solid state and molecular theory is traced over the past 66 years. The remarks are arranged chronologically starting with Plank's invention of the quantum theory in 1901; Bohr's proposal of the theory of the hydrogen atom, and the development of x-ray diffraction by Laue in 1913; Schrödinger's wave mechanics in 1926; the interruption during the war years; and the return of interest to the field during the early 1950's. After this detailed historical survey, comments are made on the directions in which future advances in solid state and molecular theory may be made. H.S.W.

N66-39440*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE ENERGY REQUIRED TO PRODUCE AN ELECTRON-HOLE PAIR IN SILICON BY TRITONS
John J. Smithbrick and Ira T. Myers Washington, NASA, Oct. 1966 17 p refs
(NASA-TN-D-3694) CFSTI: HC $1.00/MF $0.50 CSCL 20L

The energy required to produce an electron-hole pair in silicon by tritons was measured using a sandwich configuration of two silicon surface-barrier detectors with a lithium 6 layer between them. The tritons were generated by the lithium 6 (n,α) triton ($Li^6(n,\alpha)T$) reaction by using thermal neutrons. The measured value of 3.58 ± 0.04 electron volts per electron-hole pair agrees within the experimental error with the energy required to produce an electron-hole pair by alpha particles in silicon. Author

N66-39443# Los Alamos Scientific Lab., N. Mex.
RADIATION DAMAGE PRODUCTION OF INTERSTITIAL DEFECTS IN IONIC HALIDE CRYSTALS
F. E. Pretzel and J. L. Anderson [1966] 38 p refs
(Contract W-7405-ENG-36)
(LA-3501-MS) CFSTI: HC $2.00/MF $0.50

Low-temperature X-ray diffraction was used to study interstitial formation by observing lattice changes in β-irradiated ionic halide crystals at liquid nitrogen temperature. The observed unit-cell expansions of nine alkali halides, and of CaF_2 and AgCl indicate that interstitial concentrations from 10^{19} to 4×10^{20} defects/cm^3 are attained by intense bombardment. No detectable change in lattice parameter was found for four non-halogen crystals. The predominant interstitial species in various irradiated alkali halides have been inferred from studies of color centers. Optical and X-ray diffraction data show that Frenkel-type disorder is the principal form of radiation damage produced in ionic halide crystals. Lattice recovery after prolonged irradiation indicates that Frenkel disorder may change to Schottky disorder by a diffusion process. Several unique range and dose-rate effects are found in small crystals exposed to short-range β particles. More accurate determinations of the lattice expansion of LiT verify the formation of Frenkel-type at 80°K and Schottky-type disorder at 300°K. Author

N66-39452# Dayton Univ., Ohio. Dept. of Physics.
RARE EARTH ION STUDIES IN OPTICAL CRYSTALS Final Report, 1 Jul. 1964-31 Dec. 1965
Perry Pappas Yaney and Thomas Peter Graham Wright-Patterson AFB, Ohio, AF Mater. Lab., Jun. 1966 84 p refs
(Contract AF 33(615)-2040)
(AFML-TR-66-67; AD-637451) CFSTI: HC $3.00/MF $0.75

Results of studies in the following areas are reported in detail: (1) high resolution measurements on the optical absorption and fluorescence spectra of La F3:Pr(3+) and CaF2:Sm(2+) crystals at 300 and 77 K; (2) electron paramagnetic resonance spectra of the S-state ions Gd(3+) and Fu(2+) in crystals of Ca F2 at room temperature. TAB

N66-39465# Laboratory for Electronics, Inc., Boston, Mass. Solid State Electronics Lab.
RESEARCH IN FERROMAGNETICS Final Report, 16 May 1964-15 Mar. 1965
Robert J. Spain, Harvey I. Jauvtis, Patrick J. Peoples, and Ronald J. Webber Apr. 1965 246 p refs *Its* Rept.-481-A1
(Contract AF 19(628)-4197)
(AFCRL-66-136; AD-637268) CFSTI: HC $6.00/MF $1.25

A new thin film technique is described which has implications for use in a network of all-magnetic logic of a most complete and general character. The technique, called Domain Tip Propagation Logic (DTPL), makes use of the controlled growth of domains which are confined to a pattern of narrow, low coercive force

channels imbedded in a film element of generally high coercive force. Information is stored within regions of the low coercive force channels in the form of domains of reversed magnetization and propagated through the channels under the influence of an applied field by expansion of the domains at the domain tips. In this manner it is possible to control the direction of domain tip propagation and the mutual interaction between domain tips within channels brought into proximity of each other. The dependence of the direction of domain tip propagation upon the magnitude and direction of the applied field, the magnetostatic forces between neighboring domain tips and the speed of domain tip propagation are such as to allow the construction of a wide variety of magnetic thin film devices. Author (TAB)

N66-39510# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE DIFFUSION OF GASES IN ULTRA-PURE CaF_2 AND SrF_2 CRYSTALS
H. Bruch and P. Goerlich. 8 Apr. 1966. 21 p. refs. Transl. into ENGLISH from Phys. Status Solidi (Frankfurt am Main), v. 4, no. 3, 1964 p 685-696
(FTD-TT-65-1747; TT-66-62109; AD-637436) CFSTI: HC $1.00/MF $0.50

Translation of German research: the diffusion of gases in ultra-pure CaF_2 and SrF_2 crystals. Author (TAB)

N66-39631# Harry Diamond Labs., Washington, D. C.
ANNEALING OF GAMMA-RAY INDUCED DEFECTS IN Bi-DOPED GERMANIUM
Ben Tseng and George Ausman, Jr. Jun. 1966. 15 p. refs.
(HDL-TM-66-8; AD-637691) CFSTI: HC $1.00/MF $0.50

A preliminary study was made of the isochronal annealing of gamma-ray induced defects in bismuth-doped germanium in the temperature range 318 to 523 K. Comparison of the results with previous studies on arsenic- and antimony-doped germanium confirms that the annealing processes in gamma-irradiated n-type germanium are strongly dependent on type of donor impurity. A possible explanation is given for the differences in the annealing behavior, based on differences in the covalent sizes of the donors. (Author) TAB

N66-39642# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemical Engineering.
CATALYTIC AND CHEMICAL PROPERTIES OF ATOMICALLY CLEAN ELEMENTAL SEMICONDUCTOR SURFACES
Raymond F. Baddour and Charles W. Selvidge. 1 Jun. 1966. 321 p. refs.
(Contract Nonr-3963(04))
(TR-2; AD-637625) CFSTI: HC $7.00/MF $1.50

A high vacuum catalytic reactor was developed to measure the rates of catalytic and surface chemical processes occurring during the interaction between ethanol and atomically clean germanium and silicon surfaces as a function of temperature, pressure, controlled surface contamination, and bulk semiconductor doping. Germanium powders catalyzed the steady state dehydrogenation of ethanol, and the reaction rate was determined over a wide range of experimental conditions. Atomically clean germanium surfaces abstracted oxygen from ethanol producing ethylene, hydrogen, and a non-reducible surface oxide. The dehydrogenation activity of the germanium surfaces was independent of bulk doping over the entire range investigated. Ethanol was chemisorbed much more strongly by clean silicon surfaces than germanium. Silicon surfaces were oxygenated at temperatures above 300C, in a fashion similar to germanium, by ethanol; and they possessed no steady state dehydrogenation activity. The catalytic activity of the germanium surfaces was attributed to their ability to form covalent bonds with hydrogen. TAB

N66-39696*# Chicago Univ., Ill.
ELECTRONIC STRUCTURE OF METALS, CHAPTER I
Volker Heine. [1966] 78 p. refs.
(Grant NsG-352)
(NASA-CR-78881) CFSTI: HC $3.00/MF $0.75 CSCL 20L

It is emphasized that the band structures of many metals and semiconductors can be described in nearly free electron (NFE) terms with a pseudopotential for scattering by a reciprocal lattice vector. A method for calculating this pseudopotential is examined, and the necessity of achieving an accuracy of 0.01 Ry or better is pointed out. The difficulties of attaining this accuracy are discussed. The analysis of experimentally measured band structures to yield the observed pseudopotential is then described. It is stated that these pseudopotentials can be correlated with atomic structures across the periodic table, or used to calculate other properties of metals. A discussion of Landau quasi-particles is also included. H.S.W.

N66-39707*# North Carolina State Coll., Raleigh. Dept. of Electrical Engineering.
A STUDY ON THE EFFECT OF Co^{60} Γ-RADIATION ON STEAM-GROWN SiO_2 MOS STRUCTURES
Robert J. Mattauch and Robert W. Lade. 1 Sep. 1966. 182 p. refs.
(Grant NsG-588)
(NASA-CR-78941; SDL-5-588-1) CFSTI: HC $5.00/MF $1.25 CSCL 20K

MOS capacitors were fabricated on both p- and n-type silicon substrates which had been thermally oxidized in a steam atmosphere. Device curve shift along the bias voltage axis indicated that the oxide charge moved by a diffusion mechanism. That charge was positive and had an activation energy very near that of sodium in fused silica. Exposure of the devices to a gamma ray flux from a Co^{60} source shifted the device curves along the voltage axis and decreased the slope of those curves. A surface state density determination technique showed that exposure of 3.6×10^6 roentgens caused the density of charges located at the interface to increase from $10^{11} cm^{-2} eV^{-1}$ by an order of magnitude. The surface state density can be decreased by irradiation to its initial value but the oxide charge density is permanently decreased from approximately $10^{12} cm^{-2}$ to approximately $5 \times 10^{11} cm^{-2}$. A model based upon the Compton effect in the oxide is presented. Author

N66-39752*# Delaware Univ., Newark. Dept. of Physics.
EVAPORATED AND RECRYSTALLIZED CdS LAYERS Technical Report No. 11
K. W. Boer. 27 Jul. 1966. 63 p. refs. Sponsored in part by NASA
(Grant Nonr(G)-4336-(00))
(NASA-CR-79227; AD-637725) CFSTI: HC $3.00/MF $0.75 CSCL 20L

Heat treatments of evaporated CdS layers in nitrogen containing HC and traces of oxygen, and providing a transport of CdS and copper are reported. Recrystallization of areas up to several sq mm are observed. At 25C, the treated layers show mobilities of 140 to 230 sq cm/Vs, photoconductivities of 0.001 to 0.2/ohms/cm at 750 ft-c (2600K white light) with light-to-dark-current ratios of 10 to the 8th power - 10 to the 9th power and response time (decay) of 300 microsec to 1.2 ms at 100 ft-c. The level distribution and capture cross section for electrons is investigated using spectral distribution, light intensity, and temperature dependence of photoconductivity, thermally stimulated current and response time analyses. Levels at 0.23, 0.43, 0.67, 1.05 and 2.05 eV are observed and the letter three attributed to Cu-centers. Compared to other layers and single crystals, these layers show a density of <10 to the 12th power/cu cm of levels attributed to sulfur vacancies in the range between 0.3 and 0.65 eV and a not detectable amount of intrinsic defects acting as quenching centers at 0.9 and 1.35 eV. This is explained by a Cu-enhanced recrystallization in a CdS-supplying atmosphere

at temperatures (620 to 650C) below the temperatures otherwise used for crystal growth, and thereby efficient annealing of intrinsic defects Author (TAB)

N66-39800# Army Nuclear Defense Lab., Edgewood Arsenal, Md.
ELECTRON-SPIN-RESONANCE IN FAST-NEUTRON-IRRADIATED PHOSPHOROUS-DOPED SILICON
C. A. King, Jr. and A. A. Temperley Aug. 1966 27 p refs
(NDL-TM-32; AD-637937) CFSTI: HC $2.00/MF $0.50

Damage produced in phosphorus-doped silicon by fast-neutron irradiation is being investigated. Electron-spin-resonance techniques are used to obtain information which should aid in an understanding of the nature of the lattice defects produced. Preliminary observations concerning the experimental problems involved and the techniques appropriate to their solution are presented. A discussion of the background pertinent to such an investigation is also included Author (TAB)

N66-39934*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CONDUCTION THROUGH THIN TITANIUM DIOXIDE FILMS
J. Maserjian 1 Oct. 1966 49 p refs
(Contract NAS7-100)
(NASA-CR-79184; JPL-TR-32-976) CFSTI: HC $2.00/MF $0.50 CSCL 20L

Films of thickness 100–450 Å were investigated. The samples were prepared by either anodization of Ti or evaporation of TiO_2, with Au or Al evaporated for contacts. Electrical measurements included: the dependence of current and capacitance on dc voltage and temperature; the dependence of capacitance and conductance on frequency and temperature; and transient measurements of current and capacitance. A thick (3000 Å) evaporated TiO_2 film was used for measuring the dielectric constant (27.5) and the optical dispersion. An electron-transmission diffraction pattern and photo-response measurements were made. The results are interpreted in a self-consistent manner by considering the effect of a large impurity concentration in the films and a correspondingly large ionic space charge. A general relation is derived for the steady state current through structures of this kind. This in turn is quantitatively expressed for each of two possible limiting types of impurity distributions, where one type gives barriers of an exponential shape and leads to quantitative predictions in close agreement with experimental results. K.W.

N66-39956# Honeywell, Inc., Hopkins, Minn. Corporate Research Center.
A PROGRAM OF ADVANCED RESEARCH ON ENERGY BAND STUDIES OF THIN FILMS
H. H. Soonpaa and G. D. Long Mar. 1966 52 p refs
(P00146-U)

A single crystal thin film semiconductor material, $Bi_8Te_7S_5$, has been developed which can be cleaved in steps of 9.8173 Å, called a quintuple layer. A sample glued to a sapphire substrate was cleaved to a thickness of one quintuple layer (1/3 of a unit cell) and the thickness of a film was determined unambiguously to four or five significant figures. The chemical composition is known to about 1/100 of one percent. The cleaved surfaces are atomically smooth and are expected to exhibit perfectly specular reflection according to classical theory. Details of the expected behavior of the thin film material are discussed and the facilities and equipment used in its investigation are listed. The appendix contains a preprint dealing with the optical properties of films of $Bi_8Te_7S_5$. R.N.A.

N66-39960*# Honeywell, Inc., Hopkins, Minn. Corporate Research Center.
A STUDY OF THE INTERACTIONS OF MAGNETIC MATERIALS USING COUPLED FILMS WITH A CLOSED FLUX GEOMETRY, APRIL 1965–JULY 1966
T. Iwata and J. S. Sallo 2 Aug. 1966 75 p refs
(Contract NAS8-20137)
(NASA-CR-79101) CFSTI: HC $3.00/MF $0.75 CSCL 20L

The nature of coupling between ferromagnetic films separated by a non-ferromagnetic intermediate layer was investigated to provide the basic knowledge for future designs of smaller high density more reliable magnetic memories. A fundamental study of the coupling mechanism, using films prepared by vapor deposition techniques, was conducted primarily on single crystal films. A second study was made of closed flux coupled film memory elements prepared by electro-deposition on copper wires. The two investigations have led to a better understanding of the coupling mechanism and a better insight into the eventual utility that coupled films may have in magnetic memory elements. R.N.A.

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N66-39489# Utah Univ., Salt Lake City. Dept. of Chemical Engineering.
NON-ACOUSTIC COMBUSTION INSTABILITY OF SOLID PROPELLANTS
M. W. Beckstead 1 Aug. 1964 170 p refs Presented at the AIAA 3d Aerospace Sci. Meeting, New York, Jan. 1965
(Grant AF-AFOSR-466-63)
(AFOSR-66-1769; AD-637161) CFSTI: HC $5.00/MF $1.00

Non-acoustic combustion instability was examined in an uncatalyzed, a catalyzed, and two aluminized composite propellants. These propellants were studied, burning cigarette fashion, in a burner capable of operating at values of L* as small as 5 cm. It was observed that the frequency of the pressure oscillations varied with the value of L*, frequency decreasing with increasing L*. The data were correlated by plotting frequency versus the reciprocal of L*, yielding a series of constant pressure curves. This pressure effect was eliminated by using dimensionless variables, allowing all of the data for a given propellant to be correlated along the same line. A one-dimensional model is proposed that considers sinusoidal perturbations, allowing for growth of the disturbance. The pressure, the burning rate, the distributed temperature in the propellent, and the energy flux from the burning gases are the quantities perturbed. Author (TAB)

N66-39529*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL PERFORMANCE OF A 5000-POUND-THRUST ROCKET CHAMBER USING A 20-PERCENT-FLUORINE–80-PERCENT-OXYGEN MIXTURE WITH RP-1
William A. Tomazic, Franklin J. Kutina, Jr., and Edward A. Rothenberg Washington, NACA, 24 Apr. 1957 30 p refs
(NACA-RM-E57B08) CFSTI: HC $2.00/MF $0.50 CSCL 21I
(Declassified)

A 20-percent-fluorine–80-percent-oxygen mixture and RP-1 were tested in 5000-pound-thrust engine at a chamber pressure of 650 pounds per square inch absolute, and the performance and heat transfer were compared to those obtained with oxygen and RP-1. Specific impulse with fluorine addition was 248 pound-seconds per pound, a value 2.6 percent higher than the 241 pound-seconds per pound obtained with oxygen at the same volumetric oxidant-fuel ratio. At this ratio heat rejection was 1.10 Btu per square inch per second with fluorine addition and 1.25 Btu per square inch per second with RP-1 and oxygen alone. Author

N66-39598# Dynamic Science Corp., Monrovia, Calif.
PROPELLANT SPRAYS IN LIQUID ROCKET ENGINES Final Report, 1 Apr. 1965–31 Mar. 1966
Melvin Gerstein 1 Jun. 1966 179 p refs
(Contract AF 49(638)-1552)
(SN-71; AFOSR-66-1671; AD-637236) CFSTI: HC $5.00/MF $1.00

The research described in this report is directed at obtaining an understanding of the behavior of propellant sprays in a liquid propellant rocket engine under oscillating flow conditions as a means of relating combustion stability to propellant properties and injector design. The report covers: (1) an outline of the work on the instability problem; (2) the combustion instability model; (3) calculation of fluctuations in the vaporization of liquid sprays for axisymmetric injection; (4) preliminary formulation of a transient problem associated with pressure oscillations in a rocket chamber; (5) calculation of Greens function for the transient instability problem; (6) a simple example of the calculation of the spray distribution function and the stability criterion; and (7) perturbation method for calculating stability boundaries. Sections 2 and 3 are related to treating a linear type instability where all oscillations are acoustic in nature. Sec 4 deals with the development of finite amplitude waves. In Sec. 5 a method of solution of the transient instability problem is discussed. Sections 6 and 7 cover a sample calculation of the spray distribution function and stability criterion. Significant results show that droplet vaporization can be a cause of combustion instability and that stability boundaries can be predicted from injector parameters and propellant properties. Author (TAB)

N66-39930*# Thiokol Chemical Corp., Denville, N. J. Reaction Motors Div.
INVESTIGATIONS OF SPACE STORABLE PROPELLANTS (OF_2/B_2H_6) Final Report
H. Feigel 10 Jun. 1966 184 p refs
(Contract NAS3-2553)
(NASA-CR-5474; RMD-6039-F) CFSTI: HC $3.25/MF $1.00 CSCL 21I

Sea level tests were made at the 2000-pound thrust level to check out hardware. Tests with propellant-cooled and heat sink type vortex injectors showed that OF_2/B_2H_6 can deliver high specific impulse. Allowing for nozzle divergence losses and combustion efficiency, 98% of theoretical vacuum shifting equilibrium specific impulse was obtained. Injector and combustion chamber heat transfer data were acquired. Altitude performance tests showed that OF_2/B_2H_6 delivers high specific impulse at $\geq$125,000 ft. A maximum specific impulse of 384 lb_f-sec/lb_m was obtained. Experimental data were compared with the theoretical shifting and frozen equilibrium and with the predicted kinetic performance. The specific heat of liquid OF_2 was experimentally determined over a range of temperatures and pressures typical of space operations. Reliability studies were made of thrust chamber concepts capable of extended firing over many cycles of operation with OF_2/B_2H_6. Promising advanced thrust chamber concepts were evaluated. Author

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N66-38823# Tokyo Univ. (Japan). Dept. of Aeronautics.
JET PROPULSION OF AIRCRAFT
Fujio Nakanishi *In its* Selected Papers of F. Nakanishi Jun. 1966 p 215–219 (See N66-38806 24-32) CFSTI: HC $7.00/MF $1.75

The use of jet propulsion for high speed aircraft is briefly described. The performance of a ramjet engine is calculated. Expressions are presented for maximum thrust during heat addition. Efficiency and means of increasing it are mentioned. N.E.N.

N66-38824# Tokyo Univ. (Japan). Dept. of Aeronautics.
EXHAUST GAS TURBO-SUPERCHARGER OF JET ACTION OF EXHAUST GAS
Fujio Nakanishi *In its* Selected Papers of F. Nakanishi Jun. 1966 p 219–220 (See N66-38806 24-32) CFSTI: HC $7.00/MF $1.75

Mechanically driven superchargers with jet action of exhaust gas and exhaust gas turbochargers are compared. The thrust power difference and the ratio of supercharger drive power to engine output are determined. It was concluded that the mechanical drive with jet is more effective. N.E.N.

N66-38825# Tokyo Univ. (Japan). Dept. of Aeronautics.
A METHOD OF BALANCING 8-CYL. 90°-V ENGINE
Fujio Nakanishi *In its* Selected Papers of F. Nakanishi Jun. 1966 p 221–227 (See N66-38806 24-32) CFSTI: HC $7.00/MF $1.75

A method of balancing the strong horizontal force in the 8-cylinder 90°-V type engine by using an unsymmetrical crankshaft is proposed. The unbalanced inertia force is broken down into that part due to reciprocating masses and that due to rotating masses. Equations are developed for the unbalanced forces for the unsymmetrical crankshaft. N.E.N.

N66-38826# Tokyo Univ. (Japan). Dept. of Aeronautics.
ON THE BALANCING OF TWO-STROKE 12-CYLINDER ENGINES
Fujio Nakanishi *In its* Selected Papers of F. Nakanishi Jun. 1966 p 227–233 (See N66-38806 24-32) CFSTI: HC $7.00/MF $1.75

The 12 cylinder V- and W-type engines with explosions at uniform intervals and with perfect balance are studied. The crankshaft, unbalanced inertia force, and inertia couple are discussed for each type of engine, and equations for calculating the masses of counter weights attached to the crankshaft are given. N.E.N.

N66-38828# Tokyo Univ. (Japan). Dept. of Aeronautics.
SURGING OF VALVE SPRING
Fujio Nakanishi *In its* Selected Papers of F. Nakanishi Jun. 1966 p 238–244 ref (See N66-38806 24-32) CFSTI: HC $7.00/MF $1.75

Harmonic analysis is applied to cam profiles, and the surging characteristics are discussed with respect to damping valve springs. The profile is assumed to be symmetrical with respect to the line through the maximum displacement, and the harmonic coefficient of the nth order is found. Suggestions are presented for improving a cam profile so as to be surgefree over a wide range of speed. N.E.N.

N66-38830# Tokyo Univ. (Japan). Dept. of Aeronautics.
ON AUTOMATIC SUCTION VALVES
Fujio Nakanishi *In its* Selected Papers of F. Nakanishi Jun. 1966 p 249–251 (See N66-38806 24-32) CFSTI: HC $7.00/MF $1.75

The motion of the automatic suction valve set in a small 4-stroke cycle engine driven by an electric motor was photo-

graphed and analyzed. From the photographs it was found that: (1) the measured frequency (more than 30 cps) is greater than estimated without considering air flow, and (2) the frequency of the vibration does not hold consistently even when the amplitude is about constant, but becomes smaller with time. The deviation from a possible equilibrium state is considered, and the influence of air flow and engine speed on valve closing are discussed. N.E.N.

N66-38833# Tokyo Univ. (Japan). Dept. of Aeronautics.
ON THE EFFECT OF PIPE BORES ON THE CUT-OFF OF FUEL SPRAY IN INJECTION SYSTEMS WITH OPEN NOZZLES
Fujio Nakanishi *In its* Selected Papers of F. Nakanishi Jun. 1966 p 271–283 refs (See N66-38806 24-32) CFSTI: HC $7.00/MF $1.75

The upper and lower limits of oil speed for sharp cut-off in compression–ignition engines are considered theoretically. It was determined that the region in which the spray is cut-off sharply is narrow and limited. Details are given on the experiments to determine the effects of bore size on the pressure variation at nozzles for pipe diameters from 1.36 mm to 2.85 mm. It was concluded that: (1) There are lower and upper limits to oil speed in the injection pipe. (2) When the oil speed is lower than the lower limit, or the pipe is large compared with the nozzle, the pressure falls step by step. (3) If the oil speed exceeds the upper limit, or if the pipe is very small compared with the nozzle, the pressure–time curve also drops by steps. N.E.N.

N66-38834# Tokyo Univ. (Japan). Dept. of Aeronautics.
EFFECT OF SHAPE OF DISCHARGE VALVE ON THE CUTOFF OF FUEL SPRAY IN INJECTION SYSTEMS WITH OPEN NOZZLES
Fujio Nakanishi *In its* Selected Papers of F. Nakanishi Jún. 1966 p 283–295 refs (See N66-38806 24-32) CFSTI: HC $7.00/MF $1.75

The pressure variations after cut-off with different shaped discharge valves and without discharge valve are investigated. A Bosch type valve, a pure open nozzle, and a nonreturn valve with a soft spring were used. It was concluded that: (1) When the discharge valve is of ordinary shape, the form of the pressure–time curve is step-like. (2) If a Bosch valve with large injection pipe compared with the nozzle is used, pressure variation after cut-off is very severe, falling and rising suddenly. (3) When the Bosch type and an injection pipe of suitable size is used, sharp cut-off is sometimes obtained. However a secondary discharge will take place. (4) When the discharge valve is removed and a nonreturn valve is placed at the nozzle, the cut-off is always sharp. N.E.N.

N66-38925*# Thiokol Chemical Corp., Elkton, Md.
DESIGN, PROOF TEST AND DELIVERY PROGRAM OF TE-372-3 PYROGEN FOR TE-29 RECRUIT ROCKET MOTOR Final Report
4 May 1964 44 p refs
(Contract NAS9-2049)
(NASA-CR-65536; E54-64) CFSTI: HC $2.00/MF $0.50 CSCL 21H

This report describes the design modifications, proof test, and delivery phases of a program conducted to demonstrate the compatibility of initiators with the TE 372-3 PYROGEN igniters that will be used to ignite the Thiokol Recruit rocket motors on the Little Joe II vehicle. The program consisted of modifying the design of the existing Recruit PYROGEN to accommodate two (GFE) one watt, one amp initiators, static test seven PYROGENS in an inert chamber, static test one Recruit motor ignited by a modified PYROGEN, and deliver nine PYROGENS. Author

N66-39469# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SELECTION OF THE OPTIMAL DEGREE OF REACTION OF THE STAGES OF A GAS TURBINE WITH UNSHROUDED BLADES
G. V. Proskuryakov 8 Apr. 1966 22 p refs Transl. into ENGLISH from Energomashinostr. (Moscow), no. 5, 1965 p 14–17 (FTD-TT-65-1721; TT-66-62087; AD-637386) CFSTI: HC $1.00/MF $0.50

There are presented the results of computational investigations for determining the optimal degree of reaction for the stages of gas turbines with unshrouded guiding and operating blades. The work was carried out on the electronic computer Ural-I. The results are compared with the experimental data. Author (TAB)

N66-39530*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMBUSTION OF GASEOUS HYDROGEN AT LOW PRESSURES IN A 35° SECTOR OF A 28-INCH-DIAMETER RAMJET COMBUSTOR
William R. Kerslake Washington, NACA, 22 Apr. 1958 38 p refs
(NACA-RM-E58A21a) CFSTI: HC $2.00/MF $0.50 CSCL 21D (Declassified)

Gaseous-hydrogen fuel was burned in a connected-pipe combustor with a cross section equal to 35° sector of a 28-inch diameter. Eleven shrouded fuel-injector configurations were used to obtain combustion data at the following high-altitude ram-jet combustor conditions: pressure, 5 to 24 inches of mercury absolute; velocities, 340 to 160 feet per second; and inlet air temperature of 240°F. Combustion efficiencies were measured above 95 percent for wide bands of fuel-air ratios. The combustor configurations reported herein extend the efficient burning range of hydrogen at ram-jet conditions to pressure of 1/6 atmosphere; best configurations previously reported gave high efficiency to only 1/2 atmosphere. Author

N66-39531*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF NONCONSTANT AREA COMBUSTION AND MIXING IN RAMJET AND ROCKET-RAMJET HYBRID ENGINES
Andrzej Dobrowolski Washington, NASA, Oct. 1966 46 p refs
(NASA-TN-D-3626) CFSTI: HC $2.00/MF $0.50 CSCL 21A

A one-dimensional analysis of nonconstant area and nonconstant pressure burning and mixing processes is carried out using a prescribed pressure-area relation. The duct area ratio is advanced as an important parameter that affects the existence of flow solutions and the loss or buildup of the stagnation pressure ratio of the process. The critical condition of thermal choking associated with Mach number of unity for constant area duct is shown to assume other Mach values for various nonconstant area ducts. The concepts evolved are applied to idealized supersonic combustion ramjets and rocket-ramjet hybrid engines. The nonconstant area combustion in a supersonic combustion ramjet results in a better specific impulse. Also, the separate mixing and burning, each with its appropriate duct configuration, leads to better performance than simultaneous mixing and burning in the case of the augmented rocket. Author

N66-39532*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOME FACTORS INFLUENCING HEAT TRANSFER TO LIQUID–PROPELLANT ROCKET–THRUST–CHAMBER COOLANT CHANNELS
Roger C. Krueger and Arthur N. Curren Washington, NASA, Nov. 1966 30 p refs
(NASA-TN-D-3671) CFSTI: HC $2.00/MF $0.50 CSCL 21I

A digital computer program, using finite-difference techniques, was employed to obtain steady-state wall-temperature and heat-flux patterns in the cross section of a rocket-thrust-chamber coolant channel. Several peripheral distributions of the coolant and gas-side heat-transfer coefficients were assumed, and their effects on the wall-temperature and heat-flux patterns compared. The effects of changing the thickness and thermal conductivity of the channel walls and of changing the braze fillet volume of the cross section were also investigated. The channel geometry, fluid temperatures, and heat-flux level were representative of those encountered in an experimental rocket-heat-transfer program conducted at the Lewis Research Center. Experimentally obtained wall temperatures from that program were utilized in assessing the calculated results of this study and in determining which of the assumed heat-transfer-coefficient distributions were most likely to occur. Author

N66-39544*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL EVALUATION OF THROAT INSERTS IN A STORABLE-PROPELLANT ROCKET ENGINE
Jerry M. Winter, Larry D. Plews, and James R. Johnston Washington, NASA, Oct. 1966 97 p refs
(NASA-TM-X-1266) CFSTI: HC $2.50/MF $0.75 CSCL 21H

A total of 57 throat inserts for ablative-material nozzle sections were tested at a nominal throat diameter of 1.20 inches. The two propellants used were nitrogen tetroxide and a blend of 50 percent hydrazine and 50 percent unsymmetrical dimethyl hydrazine. Nominal engine conditions included a chamber pressure of 100 pounds per square inch absolute and an oxidant-fuel ratio of 2.0. The materials tested ranged from ablative-reinforced plastics to refractory alloys. No throat erosion, low outer envelope temperature, and structural integrity were the criteria for an acceptable insert. Hypereutectic zirconium carbide met these criteria after two 60-second firing cycles. Refractory metals such as tungsten and molybdenum were found to oxidize rapidly in the test environment. The refractory oxides provided good erosion resistance but suffered thermal shock failures. Pyrolytic graphite gave encouraging results but requires further design work. The best insert was a 0.040-inch-thick pyrolytic silicon carbide coating on graphite, which underwent four test cycles totalling 722 seconds before failure. Author

N66-39618*# National Aeronautics and Space Administration. Lewis Research Center, Clevelend, Ohio.
ALTITUDE PERFORMANCE OF A TURBOJET ENGINE USING PENTABORANE FUEL
Joseph N. Sivo Washington, NASA, 20 May 1957 47 p refs
(NACA-RM-E57C20) CFSTI: HC $2.00/MF $0.50 CSCL 21E
(Declassified)

A full-scale turbojet engine having a two-stage turbine was operated with pentaborane fuel continuously for 11.5 minutes at a simulated altitude of 55,000 feet at a flight Mach number of 0.8. The engine incorporated an NACA combustor designed specifically for use with pentaborane fuel. The specific fuel consumption was initially reduced 32 percent below that obtained with gasoline fuel; however, the occurrence of a 25-percent reduction in net thrust after 8 minutes of operation resulted in a subsequent increase in specific fuel consumption to a value only 11.5 percent lower than that for gasoline. Author

N66-39623*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSES FOR TURBOJET THRUST AUGMENTATION WITH FUEL-RICH AFTERBURNING OF HYDROGEN, DIBORANE, and HYDRAZINE
James F. Morris Washington, NASA, 18 Jun. 1957 26 p refs
(NACA-RM-E57D22) CFSTI: HC $2.00/MF $0.50 CSCL 21E
(Declassified)

Turbojet-engine net thrusts augmented with fuel-rich afterburning during takeoff and flight were computed. When compared at equal liquid weights, hydrogen, diborane, or hydrazine, burned at higher than stoichiometric fuel-air ratios, can produce thrusts that are, to some limit, greater than those for a 220-second specific-impulse rocket combined with stoichiometric afterburning of the turbojet fuel. At the conditions analyzed, this limit for liquid hydrogen is a liquid-air ratio of 0.16; the corresponding thrust is 27 percent greater than that for stoichiometric afterburning alone. Fuel-rich afterburning of 700°K hydrogen can yield augmented thrusts greater than those for stoichiometric combustion of 700°K hydrogen and 400°K air augmented with a 321.6-second specific-impulse rocket. Author

N66-39630# Utah Univ., Salt Lake City. Dept. of Chemical Engineering.
ACOUSTIC INSTABILITY IN COMBUSTION
Carl L. Oberg 1 Aug. 1966 197 p refs
(Grant AF-AFOSR-446-63)
(AFOSR-66-1764; AD-637160) CFSTI: HC $5.00/MF $1.00

Acoustic instability in solid propellant rockets is observed as a high-amplitude oscillation in the acoustic modes of the gas cavity, the combustion processes providing the driving energy. In general, the solid phase, i.e., the propellant, participates in the wave behavior. In this work, the behavior of both the gas phase and the solid phase were experimentally studied in a side-vented end burner. When the burner was operated with a grain in only one end, a difference in acoustic pressure amplitudes not previously reported was observed. The phenomenon was confirmed and studied in some detail. It does not affect the data used to calculate acoustic admittance values. (Author) TAB

N66-39730 General Dynamics/Convair, San Diego, Calif.
IONIZING FRONTS IN Diego, Calif. PROPULSION AND POWER GENERATION SYSTEMS Final Report
Jan Rosciszewski 2 May 1966 11 p refs
(Contract AF 49(638)-1556)
(GD/C-DBE-66-005; AFOSR-66-1178; AD-637494) CFSTI: HC $1.00/MF $0.50

The program incorporates two major items: (a) study of the efficiency of different systems of plasma propulsion devices together with a discussion of the physical phenomena associated with the energy transformation losses; (b) study of the physical parameters associated with the plasma flow such as the effect of current density resulting from ionization in a magnetic field. Other items are the influence of radiation on ionization behind a shock wave, the structure of the rarefaction discharge layer and others. In addition the feasibility of a new type of power generator and a nuclear rocket was investigated Author (TAB)

N66-39835# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Stuttgart (West Germany). Institut fuer Plasmadynamik.
EXPERIMENTAL INVESTIGATIONS WITH CATHODES OF MPD-ARC JET ENGINES [EXPERIMENTELLE LICHTBOGEN-TRIEBWERKEN]
Helmut Huegel May 1966 47 p refs In GERMAN; ENGLISH summary
(DLR-FB-66-52; DVL-554) CFSTI: HC $2.00/MF $0.50

The experiments with a cathode of 8 mm diameter and 50 mm length made of thoriated tungsten are supplementarily continued and concluded. The manifestation phase of the cathodic onset of the arc and the temperature distribution of the cathode are studied by varying the following parameters: type of working gas (Ar, He, N_2, H_2), current (400 to 1000 amps), environmental pressure (20 to 120 mm Hg), mass flow rate (0.08 to 1.9 g/s. The experiments indicate that the type of gas affects the appearance of the arc onset considerably. Higher currents and lower mass

flow rates lead to an increase of the cathode temperature, whereas higher pressures cause a slight decrease. These effects are basically the same in all gas types, although in varying degrees. Author

N66-39908*# Aerojet-General Corp., Azusa, Calif.
INVESTIGATION OF SPACE RENDEZVOUS PROPULSION SYSTEM REQUIREMENTS. VOLUME I: SUMMARY
C. A. Lysdale Jan. 1963 36 p refs *Its* Rept.-2555, Vol. I
(Contract NAS7-87)
(NASA-CR-79121) CFSTI: HC $2.00/MF $0.50 CSCL 21H

Summarized are research in the following basis areas of study: (1) literature review, (2) independent analysis of the rendezvous phases, (3) analysis of representative rendezvous missions, and (4) conceptual and preliminary design of rendezvous propulsion systems. The phases studies included ascent, orbit transfer, midcourse correction, closure, and docking. In addition, an attitude control analysis and an analysis of engine transient and control effects, were also studied. Three different missions, which were considered representative of the rendezvous missions to occur in the next 10 to 15 year period, were examined. These missions were: (1) earth-orbit rendezvous of Saturn C-5 payloads, (2) earth-orbit rendezvous with a space station, and (3) lunar-orbit rendezvous. The primary purpose of examining the rendezvous phases and missions was to establish propulsion requirements such as characteristic velocity, thrust-to-mass ratio, thrust variability, number of restarts, and thrust vector control requirements. The subsequent design studies define the best type of propulsion system and vehicle for completion of the rendezvous missions. S.C.W.

N66-39927*# Electro-Optical Systems, Inc., Pasadena, Calif.
PROGRAM TO DEVELOP AND DEMONSTRATE METHOD TO DEFLECT BEAM FOR ION THRUSTOR Final Progress Report, 6 Dec. 1965–6 Jun. 1966
R. M. Worlock 26 Jun. 1966 45 p
(Contract NAS3-7936)
(NASA-CR-72091; EOS-7028-Final) CFSTI: HC $2.00/MF $0.50 CSCL 21C

Beam deflections of zero to six degrees relative to the thrustor axis of symmetry were produced in each of three equally spaced azimuthal directions by means of potentials applied to an array of electrostatic deflection electrodes. Two ion thrustor systems, each consisting of thrustor, propellant feed, beam deflection electrodes and console for supplying, controlling, and measuring all power to the thrustor, were fabricated and operated to demonstrate beam deflection. Selected environmental tests were successfully conducted on one of the thrustors. Author

N66-39965# Honeywell, Inc., Minneapolis, Minn. Aeronautical Div.
FEASIBILITY STUDY OF AN IN-FLIGHT FLAMEOUT AND ENGINE-OUT DETECTION SYSTEM Final Report
John G. Mc Millan and Albert L. Preston Jun. 1966 45 p *Its* Rept.-20324-FR
(Contract DA-44-177-AMC-305(T))
(USAAVLABS-TR-66-41; AD-637159) CFSTI: HC $2.00/MF $0.50

The document is the final report of a feasibility study to develop a flameout monitor for a gas turbine engine. During the course of the study, it was determined that two different systems, one fluidic and one electronic, should be investigated and tested. Both systems were breadboarded and tested on a J85-7 turbojet engine. Test results described in this document show that both systems meet contract specifications for response time and that each has certain inherent advantages. Author (TAB)

N66-39974*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PROMISES AND POTENTIALITIES OF ELECTRIC PROPULSION STATUS OF THRUSTOR PERFORMANCE
W. E. Moeckel Washington, NASA, 1966 6 p For Presentation at the 3d Ann. Meeting and Tech. Display, Boston, 29 Nov.–2 Dec. 1966; sponsored by AIAA
(NASA-TM-X-52241) CFSTI: HC $1.00/MF $0.50 CSCL 21C

This state-of-the-art review briefly covers performance and future programs and prospects of electric thrustors. Specifically discussed are operating lifetime and overall efficiency as a function of specific impulse. Included are the electron bombardment ion thrustor, the magnetic plasma arc thrustor, the electrothermal thrustor, and the ion accelerator. The application potential of electric thrustors for NASA programs and future interplanetary missions is pointed out. K.W.

N66-39982*# National Aeronautics and Space Administration, Washington, D. C.
EXPERIMENTAL RESEARCH ON ELECTRIC PROPULSION. NOTE VII: ANALYSIS OF THE PERFORMANCE OF AN ARCJET DRIVEN BY HYDROGEN AND NITROGEN [RICERCHE SPERIMENTALI SULLA PROPULSIONE ELETTRICA. NOTA VII: RILIEVO DELLE PRESTAZIONI DI UN ARCOGETTO OPERANTE CON IDROGENOE CON AZOTO]
Aurelio C. Robotti and Mario Oggero Oct. 1966 14 p refs Transl. into ENGLISH from Ric. Sci., Anno 35, ser. 2 Rend. (Rome), v. 8, no. 4, 1965 p 894–901
(NASA-TT-F-10307) CFSTI: HC $1.00/MF $0.50 CSCL 21C

Description of experiments performed on a new type of arcjet, characterized by composite electromagnetic and vortex stabilization and propelled by hydrogen and nitrogen in turn. Particular attention was devoted to the electrical characteristics of the arc and to the loss of heat through electrodes. Author

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N66-38946*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE SOLAR WIND
Robert J. Mackin, Jr. and Marcia Neugebauer, ed. 1966 400 p refs Proc. of the JPL Conf. on the Solar Wind held 1–4 Apr. 1964
(Contract NAS7-100)
(NASA-CR-78202; JPL-TR-32-630) CFSTI: HC $7.00/MF $2.00 CSCL 20H

Conference papers on interplanetary space phenomena, theories of interplanetary plasma and fields and of energetic particles, origin of the solar wind and of the corona, solar wind and the magnetosphere, and solar wind interaction with comets and with the moon are presented. For individual titles see N66-38947–N66-38974.

N66-38947*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MARINER-2 MEASUREMENTS OF THE SOLAR WIND
Marcia Neugebauer and Conway W. Snyder *In its* The Solar Wind 1966 p 3–23 refs (See N66-38946 24-29) CFSTI: HC $7.00/MF $2.00

The methods used for calculating velocity, temperature, and density from the data obtained from the Mariner-2 plasma experiment are outlined. Graphs of proton velocity and temperature as a function of time show that when the velocity increased, the temperature generally increased. The average proton temperature was 1.5×10^5°K. Proton density was found generally highest

between the high velocity streams or at a leading edge. It is shown that the alpha particle temperature is approximately four times the proton temperature, or that the two kinds of ions have equal velocities. From this result it is suggested that the solar wind particles have random motions because the ions are interacting with the magnetic field disturbances. From the data presented, it is concluded that the temperature of the solar wind plasma is not simply related to the temperature at the base of the corona and that shock wave heating may be an important process. H.S.W.

N66-38948*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE RELATION OF MARINER-2 PLASMA DATA TO SOLAR PHENOMENA
Conway W. Snyder and Marcia Neugebauer *In its* The Solar Wind 1966 p 25-34 refs (See N66-38946 24-29) CFSTI: HC $7.00/MF $2.00

An attempt is made to correlate data from Mariner-2 measurements of the solar wind to solar phenomena. The problems of making detailed correlations between theory and experimental values are examined. It is reported that the data seem to indicate that there is no close correlation between the plage regions and the solar streams, unless either the velocity is not constant, or the high velocity plasma is not shot out from the Sun in a radial direction, so that the simple Archimedes spiral model is incorrect. H.S.W.

N66-38950*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE RELATIONSHIP BETWEEN HIGH-ENERGY PARTICLES IN SPACE AND THE SOLAR PLASMA
Hugh R. Anderson *In its* The Solar Wind 1966 p 53-67 refs (See N66-38946 24-29) CFSTI: HC $7.00/MF $2.00

The effect of the magnetic field on the radiation measured by Mariner-2 is discussed in terms of two types of modulation: (1) the modulation of galactic cosmic radiation, and (2) the determination by the field of the propagation and storage of charged particles injected into the interplanetary medium by the Sun. Data are introduced and analyzed to show that there can be a systematic dependence of average flux on distance from the Sun. It is additionally shown that the magnetic field imbedded in the solar wind probably does modulate the galactic cosmic radiation inside the orbit of the Earth, and that this has an important effect on the propagation of particles from the Sun. H.S.W.

N66-38951*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SATELLITE OBSERVATIONS OF ME V PHENOMENA RELATED TO THE SOLAR WIND. EXPLORER-12 OBSERVATIONS. IMP OBSERVATIONS OF PRIMARY 3-MEV ELECTRONS
D. A. Bryant, T. L. Cline, V. D. Desai, F. B. Mc Donald, and G. H. Ludwig *In* JPL The Solar Wind 1966 p 69-81 refs (See N66-38946 24-29) CFSTI: HC $7.00/MF $2.00

A discussion is presented of the periodic modulations of solar-proton intensity measured by Explorer 12. The fluctuations observed appeared to be greater than statistical fluctuations. Since they are simultaneous over too wide a range of proton velocities to have been caused by direct solar influence, it is stated that they are of local interplanetary origin, or they originate in the region between the magnetopause and the shock front. The 27 day variation in the intensity of very low energy protons observed by Explorer 12 is also examined. Results from IMP satellite observations are also treated, and evidence is given that electrons of extraterrestrial origin, with energies of approximately 3 Mev, were detected in interplanetary space. H.S.W.

N66-38953*# California Inst. of Tech., Pasadena.
RADIO ASTRONOMY OBSERVATIONS IN RELATION TO THE SOLAR-WIND PROBLEM
J. D. Wyndham *In* JPL The Solar Wind 1966 p 109-122 refs (See N66-38946 24-29) CFSTI: HC $7.00/MF $2.00

The application of the techniques of radio astronomy to the study of the interplanetary medium is discussed. It is stated that these techniques permit investigations of the broad features of the solar corona and interplanetary space; the radial variation of electron density; and the mean direction of the coronal magnetic field. Additionally, limits can be placed on the size of coronal irregularities. The observational procedures are outlined and data obtained from two radio sources—Crab Nebula and 3C 123—are examined. A model of the extended corona, consistent with the radio data, was constructed. Using this model and the 1960-62 results of the variation of scattering with radial distance, the limits within which the radial law of electron density must lie were calculated. H.S.W.

N66-38954*# Massachusetts Inst. of Tech., Cambridge.
WHAT WE KNOW AND WHAT WE DON'T KNOW ABOUT THE SOLAR WIND
H. S. Bridge *In* JPL The Solar Wind 1966 p 123-143 refs (See N66-38946 24-29) CFSTI: HC $7.00/MF $2.00

Parker's theory of the solar wind is used to provide a framework for this discussion. Theoretical predictions are compared with the observations made by satellites such as Pioneer, Lunik 2 and Lunik 3, Explorer, Mariner, and IMP. Areas in which unanswered questions still exist are identified; however, it is stated that the satellite results should provide new information concerning the magnetic field and plasma configurations, and this information may provide the answers for these questions. H.S.W.

N66-38955*# California Inst. of Tech., Pasadena.
MODELS OF THE INTERPLANETARY FIELDS AND PLASMA FLOW
Leverett Davis, Jr. *In* JPL The Solar Wind 1966 p 147-164 refs (See N66-38946 24-29) CFSTI: HC $7.00/MF $2.00

This discussion of solar wind models emphasizes two factors. First, long lived jets of high velocity gas are ejected from the Sun; and secondly, the interplanetary magnetic field component perpendicular to the ecliptic seems to be predominantly directed toward the south. These factors are examined briefly, and from this discussion three models are considered. The first model is one in which irregular structures are formed in the corona and then blow out as separate units. In the second model, short loops of field lines rise above the photosphere. The tops of the loops are blown outward at periodic intervals, and the bottoms are left connected to the Sun. In the preferred model the ratio of the magnetic stress to the momentum flux of the solar wind is very small and the wind dominates. Features of the preferred model are pointed out and evidence for its validity are given. H.S.W.

N66-38956*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EVIDENCE FOR A COLLISION-FREE HYDROMAGNETIC SHOCK IN INTERPLANETARY SPACE
C. P. Sonett, D. S. Colburn, and B. R. Briggs *In* JPL The Solar Wind 1966 p 165-175 refs (See N66-38946 24-29) CFSTI: HC $7.00/MF $2.00

The collision-free hydromagnetic shock observed almost simultaneously by Mariner, ground-based magnetometers, and Explorer XIV is analyzed. Illustrations are presented for the magnetic field and proton flux observed by Mariner II, the ground-based magnetometer records, and plasma detector measurements. Properties of this event in the shock-plane coordinate system are examined, and the energy equation is treated. S.P.

N66-38957*# California Inst. of Tech., Pasadena.
MAGNETIC FIELDS IN THE SOLAR PHOTOSPHERE
R. B. Leighton *In* JPL The Solar Wind 1966 p 177-184 ref (See N66-38946 24-29) CFSTI: HC $7.00/MF $2.00

Various representations of magnetic field lines in the solar photosphere are examined. Data include a pictorial record of the magnetic fields in regions near sunspot groups, and a magnetic pattern with bright south-polarity regions and dark north-polarity regions. A spectroheliogram is presented to illustrate another case in which the bright regions are concentrations of the magnetic field. A representation of the magnetic field on the Sun is also presented in solar magnetograms. S.P.

N66-38958*# Chicago Univ., Ill.
THE PENETRATION OF GALACTIC COSMIC RAYS INTO THE SOLAR SYSTEM
E. N. Parker *In* JPL The Solar Wind 1966 p 185–196 refs (See N66-38946 24-29) CFSTI: HC $7.00/MF $2.00

Reduction of cosmic ray intensity due to penetration of interstellar cosmic rays into the solar system is discussed. The Forbush decrease, which follows a flare on the Sun is considered. Physical properties of the reduction caused by outward convection of small-scale irregularities in the underlying magnetic pattern are examined. The 27-day and diurnal variations in the cosmic-ray intensity are also mentioned. Theoretical problems involved in developing a more quantitative model are described. S.P.

N66-38959*# Space Technology Labs., Inc., Redondo Beach, Calif.
THE ORIGIN OF THE SOLAR WIND
F. L. Scarf *In* JPL The Solar Wind 1966 p 199–214 refs (See N66-38946 24-29) CFSTI: HC $7.00/MF $2.00

Theories and quantitative fluid models of the solar corona are considered in a discussion on the origin of solar wind. The question of why the solar corona flows continuously in a supersonic mode rather than a subsonic one is raised. The problem of coronal heating is considered, and the full Navier-Stokes equations are given for radial flow. Velocity distributions and field effects are discussed, and evidence for the termination of solar wind is proposed. The origin and stabilization of the solar wind are considered in view of the concept of a dynamic pressure balance. S.P.

N66-38960*# California Inst. of Tech., Pasadena.
EFFECTS OF DIFFUSION ON THE COMPOSITION OF THE SOLAR CORONA AND THE SOLAR WIND
J. P. Jokipii *In* JPL The Solar Wind 1966 p 215–219 refs (See N66-38946 24-29) CFSTI: HC $7.00/MF $2.00

An investigation of the effects of radial diffusion in the solar corona and solar wind is presented. Results indicate that the solar wind leaves ions behind in the lower corona, tending to increase their coronal abundance and to decrease their solar-wind abundance. A simple model is developed for obtaining a quantitative estimate of this settling out, and estimates are limited to alpha particles. S.P.

N66-38961*# Avco-Everett Research Lab., Everett, Mass.
RECONNECTION AND ANNIHILATION OF MAGNETIC FIELDS
H. E. Petschek *In* JPL The Solar Wind 1966 p 221–228 refs (See N66-38946 24-29) CFSTI: HC $7.00/MF $2.00

A mechanism for magnetic-field reconnection is proposed which provides for a more rapid disconnection of field lines from the Sun than previous estimates. An idealized plasma configuration is analyzed in which two adjacent magnetic-field regions have oppositely directed field lines. The problem of determining the velocity at which these field lines approach each other and become reconnected is considered. It is proposed that the process for bringing the field lines together is rapid, and that the approach velocities are not too different from the expected fluid-flow velocities involved. S.P.

N66-38962*# Cornell Univ., Ithaca, N. Y.
SOLAR-WIND INTERACTION WITH THE MAGNETOSPHERE: FLUID DYNAMIC ASPECTS
W. I. Axford *In* JPL The Solar Wind 1966 p 231–241 refs (See N66-38946 24-29) CFSTI: HC $7.00/MF $2.00

The flow of the solar wind past the magnetosphere as a fluid flow is discussed. The problem of whether solar particles can get into the cavity in the plasma is described, and it is proposed that particles bring into the magnetosphere from outside the extra energy present during magnetic storms. The problem of entry of particles from the Sun is also considered, and the theory that background particles belonging to the Earth's far reaching atmosphere are in some way accelerated and energized is advanced. The question of whether that part of the cavity behind the Earth is open or closed is examined, and it is concluded that it is closed at a distance of more than 60 R_E. Author

N66-38963*# Imperial Coll. of Science and Technology, London (England).
SOLAR-WIND INTERACTION WITH THE MAGNETOSPHERE: PARTICLE ASPECTS
J. W. Dungey *In* JPL The Solar Wind 1966 p 243–255 refs (See N66-38946 24-29) CFSTI: HC $7.00/MF $2.00

The motion of individual particles in the connected model of the magnetosphere and the interplanetary magnetic field is considered. A brief discussion of the topology of the geomagnetic field, and the electric field in the magnetosphere is provided. Chamberlain's mechanism for producing auroras is examined in the light of the model being considered, and those areas which are satisfield by the model are pointed out along with those areas in which discrepancies appear. H.S.W.

N66-38964*# Avco-Everett Research Lab., Everett, Mass.
THE MECHANISM FOR RECONNECTION OF GEOMAGNETIC AND INTERPLANETARY FIELD LINES
H. E. Petschek *In* JPL The Solar Wind 1966 p 257–273 refs (See N66-38946 24-29) CFSTI: HC $7.00/MF $2.00

The processes that occur at the neutral point between the Earth's dipole field and the interplanetary field are examined for the purpose of deriving a quantitative estimate of field cutting efficiency at the magnetopause. The logic of the analysis is outlined and the expected magnitude of the internal convection pattern is estimated. H.S.W.

N66-38966*# Institute for Defense Analyses, Washington, D. C.
THE MOTION OF PARTICLES TRAPPED IN THE MAGNETOSPHERE
E. W. Hones, Jr. *In* JPL The Solar Wind 1966 p 281–294 refs (See N66-38946 24-29) CFSTI: HC $7.00/MF $2.00

The computer program written to study the motions of particles in the magnetosphere, calculates the drift of particles under the influence of the magnetic field gradient, magnetic line curvature, an electric rotational field, and an electric field across the tail of the magnetosphere. This code was used to study the motions of particles assumed to be injected and initially mirroring near the magnetic neutral lines at the front of the magnetosphere. Some of the results of these calculations support the view that solar wind particles may enter the magnetosphere at the front. It is also suggested that the magnetospheric plasma rotates even at large radial distances, and this rotation is the reason for the broad H α emission observed south of the evening auroral arcs. Additionally, the morning and evening precipitation patterns, spiralling from high latitude near noon to low latitude near midnight, imply that particle streams move from the front of the earth toward the back. H.S.W.

N66-38967*# Massachusetts Inst. of Tech., Cambridge.
EXPLORER-18 PLASMA MEASUREMENTS
E. F. Lyon *In* JPL The Solar Wind 1966 p 295–314 refs (See N66-38946 24-29) CFSTI: HC $7.00/MF $2.00

Some of the data obtained from the Explorer-18 plasma measurement experiment are described and the conclusions drawn from these data are presented. The instrumentation used and the sequence and timing of the measurements are discussed. The evidence of the satellite's passage through the shock front and through the magnetopause is singled out as the most distinctive feature of the plasma data. An attempt is made to fit the data obtained into models of the magnetosphere and the magnetopause. H.S.W.

N66-38970*# Max-Planck-Institut fur Physik und Astrophysik, Munich (West Germany).
THE INTERACTION OF THE SOLAR WIND WITH COMETS (NATURAL AND ARTIFICIAL)
Ludwig Biermann and Reimar Luest *In* JPL The Solar Wind 1966 p 355–363 refs (See N66-38946 24-29) CFSTI: HC $7.00/MF $2.00

The action of the solar plasma upon comets is considered with stress placed on the value of comets as probes of the solar plasma and interplanetary space, especially in regions far from the Earth and from the near-ecliptic regions traversed by spacecraft. Evidence is presented for the solar-wind interaction with comets based on observed accelerations in ionized comet tails, the correlation between the geomagnetic and cometary disturbances, and the aberration angle caused by the component of the comet's orbital velocity perpendicular to the radius vector. Mass flow; charge transfer; and transfer of momentum and energy by long-range Coulomb collisions, plasma instabilities, and magnetic fields are discussed as types of interaction. Some preliminary ion-cloud experiments are described to aid in understanding the physics of comets and their interaction with the solar wind. The use of artificial comets as probes in the form of ion clouds ejected from satellites is suggested. It is inferred that the interplanetary plasma does not rotate with the Sun at the distance of the Earth's orbit, nor beyond half this distance. S.P.

N66-38971*# Max-Planck-Institut fur Physik und Astrophysik, Munich (West Germany).
MAGNETOHYDRODYNAMIC ASPECTS OF THE INTERACTION OF THE SOLAR WIND WITH COMETS
Ludwig Biermann *In* JPL The Solar Wind 1966 p 365–371 refs (See N66-38946 24-29) CFSTI: HC $7.00/MF $2.00

The interaction between comets and the solar wind is discussed from the view of magnetohydrodynamics and fluid dynamics. Equations of magnetohydrodynamics, specifically the three-fluid equations for a mixture of electrons and two kind of ions, are used. In addition, equations of magneto-fluid dynamics, which express the usual conservation laws for the plane-parallel case, are included for more detailed study of comet–solar wind interaction. Equations are presented for ion density, mass, transfer of momentum, conservation of magnetic flux, and conservation of the mean magnetic moment of the proton's gyration. The result obtained from the latter two equations refers to the solar wind interaction with the rarefied cometary gas at large distances (toward the Sun) from the comet. S.P.

N66-38972*# California Univ., Davis.
A THEORY OF TYPE-I COMET TAILS
David B. Beard *In* JPL The Solar Wind 1966 p 373–380 refs (See N66-38946 24-29) CFSTI: HC $7.00/MF $2.00

A criticism is presented of the theory that the charge exchange process accounts for the behavior of Type I comet tails. Although charge exchange certainly occurs, and probably accounts for the start of the tail formation, it is stated that charge exchange cannot account for the high ion densities observed in comet tails. Evidence is given that tail rays are formed by energetic electrons in the transition layer that is located on the outer surface of slowed interplanetary magnetic field lines. H.S.W.

N66-38973*# Cornell Univ., Ithaca, N. Y.
THE MAGNETOSPHERE OF THE MOON
T. Gold *In* JPL The Solar Wind 1966 p 381–391 refs (See N66-38946 24-29) CFSTI: HC $7.00/MF $2.00

Solar plasma activity on the Moon is considered on the assumptions that the Moon has no magnetic field and that the solar wind is hitting its surface. From the accompanying diagrams it is inferred that the magnetic field lines carried with the plasma will be forced some distance into the sunward face of the Moon; electric forces will be associated with their distortion. The crowded field lines on the sunward side will be bounded by a shock front. Variations of the solar-plasma flow and the field carried with it will produce considerable variations in the shock front. It is concluded that the magnetic measurements made by a satellite orbiting very close to the Moon may reveal the time history of long-past solar-plasma flow. Other conclusions are that the impact of solar electrons may produce X-rays dangerous to lunar explorers, and that the impact of the solar plasma will preclude any buildup of a lunar atmosphere from gaseous radioactive-decay products exhaled from within the solid body of the Moon. S.P.

N66-38974*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A PROBABLE OBSERVATION OF THE WAKE OF THE MOON
N. F. Ness *In* JPL The Solar Wind 1966 p 393–400 refs (See N66-38946 24-29) CFSTI: HC $7.00/MF $2.00

Data representing evidence for a magnetohydrodynamic wake of the Moon as it interacts with the solar wind are examined. Information from the first four orbits of IMP is used to support the existence of this field-free tail called a magnetic corpuscular eclipse region bordered by an irregular magnetic field. Satellite and lunar positions for detection of the wake are plotted, and a schematic diagram is included to show the wake concept and its length. It is suggested that the magnetic eclipse region is of considerable extent, but it remains for future satellite exploration to reveal whether the eclipse is able to affect the magnetosphere and to cause any observable magnetic change at the Earth's surface. S.P.

N66-38992# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DISTRIBUTION OF ELECTRONS WITH E > 40 KEV BY PITCH ANGLES IN INNER BELT ACCORDING TO DATA FROM KOSMOS 5 SATELLITE
O. L. Vaysberg and F. K. Shuyskaya *In its* Cosmic Res., Vol. III, No. 6 [1966] p 134–153 refs (See N66-38986 24-30) CFSTI: HC $6.00/MF $1.25

Directional intensity distributions at altitudes of 1000–1600 km were obtained in June 1962 for several orbits of the satellite. The distributions at the mirror points were constructed in the natural geomagnetic coordinates B and L assuming conservation of magnetic moment. The width of the pitch distributions and the corresponding B, L-diagrams indicate a dependence on longitude (or on local time at the point of observation). The intensities calculated from the pitch distributions agree with measurements made at a 90° angle to the line of force of other passes through the same drift shell in approximately the same longitude interval. At longitudes in the Pacific Ocean, the directional intensity on drift paths crossed in the region of the South Atlantic anomaly at an altitude of 250 km reaches $2 \cdot 10^6$ electrons/cm^2·sec·steradian for L=1.5. In the South Atlantic anomaly and beyond it, the pitch-distribution width remains large. It narrows during the day at longitudes >0°, with a corresponding decrease in the intensity along drift trajectories. The existence of electric fields of ionospheric origin in the magnetosphere is inferred from the results. K.W.

N66-38994# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE NATURE OF RADIO NOISE EMISSION FROM THE SURFACE OF VENUS
V. M. Vakhnin and A. I. Lebedinskiy *In its* Cosmic Res., Vol. III, No. 6 [1966] p 177–197 refs (See N66-38986 24-30)
CFSTI: HC $6.00/MF $1.25

The somewhat high level of radio noise emission of Venus (600°–700°K) can be accounted for by "quiet" or "glow" discharges in the upper atmosphere, which produce a 200°–300°K increase in radio noise above the true thermal emission. The main factor determining the "quiet" or "glow" atmospheric discharge on Venus would not be the electrical-storm phenomena characteristic for the earth, but may be the extremely slow rotation of the planet and the resulting low-turbulence, very intense atmospheric circulation covering almost all of its surface. Calculations of the efficiency with which solar thermal energy is converted into radio-noise energy through intermediate stages—into energy of atmospheric circulation and into electrical-current energy—indicates that the proposed "gas-discharge" model of the radio noise is realistic. Author

N66-39497# Lund Univ. (Sweden). Dept. of Physics.
HEAVY PARTICLES IN THE PRIMARY COSMIC RADIATION Final Scientific Report
S. Vonfriesen 26 May 1966 15 p refs
(Grant AF-EOAR-64-35)
(AFOSR-66-1712; AD-637557) CFSTI: HC $1.00/MF $0.50

The investigations were mainly concentrated on studies of the composition of the radiation with special emphasis on the relative frequency of the heavy nuclei. TAB

N66-39643# Air Force Cambridge Research Labs., Bedford, Mass. Space Physics Lab.
COLLECTED AND CORRECTED SOLAR FLARE REPORTS, 1955–1964 Special Reports No. 50
Hans J. E. Fischer and Delos C. Jensen Jul. 1966 36 p refs
(AFCRL-66-483; AD-637776) CFSTI: HC $2.00/MF $0.50

The flare data were compiled primarily from the flare lists of the IAU Quarterly Bulletin and a magnetic tape obtained from the Institute for Telecommunication Sciences and Aeronomy (ITSA). This tape was assembled from the CRPL-F Part B series (1955 through 1964) and included sub-flare reports. Altogether, 84,600 reports were compiled. In preparing the revised tape, tests were made for errors that were introduced at various stages in the handling of the data. Some errors were detected by comparing the entries for flare time, position, and importance of the flare reports found in both the CRPL and IAU flare lists. Only slightly more than one-third of all reports were so compared, but these included practically all flares of importance > or = 1 during the period 1955 through 1962. Errors in reported flare areas were detected by matching reports between the two flare lists and by testing the areas as a function of central distance. This check uncovered flare reports in which the measured and corrected areas were reversed. Other errors were detected by checking for consistency of the information within each flare report. These various tests disclosed a 12.5 percent error in the flare reports of the CRPL-F Part B series, and an 11.2 percent error in the Quarterly Bulletin flare list. After correction of all identified errors, the revised magnetic tape listing may still contain a 5 percent error. Most of these discrepancies are in the sub-flare reports. TAB

N66-39678*# Radiological Defense Lab., San Francisco, Calif.
CHARGED PARTICLE TRACKS IN POLYMERS: NUMBER 2—REGISTRATION OF HEAVY IONS DURING THE FLIGHT OF GEMINI VI
Eugene V. Benton and Michael M. Collver 23 Jun. 1966 20 p refs Sponsored by NASA
(NASA-CR-79200; USNRDL-TR-1037; AD-637531) CFSTI: HC $1.00/MF $0.50 CSCL 18D

Several small disks of cellulose nitrate plastic were included as a part of a dosimetry package aboard the Gemini VI spacecraft for the purpose of recording the heavy component of the primary cosmic radiation. An average of 10 tracks/sq cm - day was found in the plastic detectors. Most of these were judged to be tracks of heavy recoil ions; about 1 track/sq cm - day was judged to be due to the primary cosmic ray particles Author (TAB)

N66-39686*# Ewen Knight Corp., East Natick, Mass.
CHARACTERISTICS OF SOLAR ACTIVITY AT 4 AND 8.6 MILLIMETERS Final Report, May 1, 1965–Jul. 1, 1966
Jul. 1966 90 p refs *Its* Doc.-1158
(Contract NASW-1118)
(NASA-CR-78993) CFSTI: HC $3.00/MF $0.75 CSCL 03B

A dual frequency millimeter solar radio telescope was assembled for the purpose of obtaining a measure of the average solar flux intensity and burst activity at wavelengths of 8.6 and 4 millimeters. The quiet sun flux intensity at 8 mm was measured by direct comparison with the known flux intensity of the moon. The measured brightness temperature is 8,000°K corresponding to a flux intensity of 2×10^{-19} watts/m^2/Hz. Similar measurements were attempted at the 4 millimeter wavelength. The sensitivity of the instrument at the time of observation precluded attempted significant result. In addition to short term burst activity, continuous complex activity was also noted. This phenomena, not previously observed, consists of a combination of all three types of events and occurs over the period of several hours, and in some cases, several days. The correlation of this phenomena with events at other frequencies over a longer time base is in progress. Author

N66-39762*# California Univ., Berkeley. Space Sciences Lab.
INFLUENCE OF INTERPLANETARY MAGNETIC FIELD AND PLASMA ON GEOMAGNETIC ACTIVITY DURING QUIET-SUN CONDITIONS
John M. Wilcox, Kenneth H. Schatten, and Norman F. Ness 2 Aug. 1966 36 p refs *Its* ser. no. 7, issue no. 29
(Grant NsG-243; Contract Nonr-3656(26))
(NASA-CR-79228; AD-637207) CFSTI: HC $2.00/MF $0.50 CSCL 03B

Observations by the IMP-1 satellite of the interplanetary magnetic field and plasma were compared with the three-hour geomagnetic activity index Kp. The average Kp is approximately a linear function of the interplanetary field magnitude B in gammas (Average Kp = (0.33 plus or minus 0.02) B plus or minus 0.2). It appears significant that this relation between Average Kp and field magnitude passes through the origin, whereas the linear relation between Average Kp and solar wind velocity does not. The average Kp is approximately a linear function of solar wind velocity, but with perhaps a slightly different slope and zero-intercept from the similar relation observed by Snyder, Neugebauer and Rao with Mariner 2. Little correlation is observed between Average Kp and solar wind density, but this result is consistent with the interplanetary sector pattern discussed by Wilcox and Ness. Cross-correlation as a function of time lag of Kp and interplanetary field (or solar wind velocity) yields a positive peak correlation at zero lag, suggesting that a large part of the response of the magnetosphere to solar wind excitation occurs within the three-hour Kp period Author (TAB)

N66-39837 Utrecht Observatory (Netherlands).
SUNSPOT MODELS—A STUDY OF SUNSPOT SPECTRA
C. Zwaan 1965 187 p refs Supported in part by the Netherlands Organ. for Sci. Res. *Its* Vol. XVII, No. 4

Various aspects of the radiation of sunspots are discussed to obtain an empirical model atmosphere of the umbra. Stray light coming from the penumbra and from the photosphere is discussed with respect to its vitiation of intensity measurements

and spectrograms of umbrae. Observations of the continuous radiation of sunspots are examined, and temperature models are derived from these data. To enable testing of this model the continuous opacity, pressure distributions, and formation of the absorption lines are considered. The model is tested by the observed equivalent widths of atomic and ionic lines. Measurements of the magnetic field are discussed, and abnormal splitting patterns are explained in many cases by stray light rather than by a complex structure of the magnetic field. The sunspot is described as a stable structure in the solar mantel, with the magnetic forces and the Wilson effect taken into account. A qualitative discussion of sunspot growth is presented, and a tentative mechanism for solar flares is outlined. An observational program is suggested for determining more accurately the physical conditions in a sunspot. S.P.

N66-39899*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE RELAY I RADIATION EFFECTS EXPERIMENT
Ramond C. Waddel Washington, NASA, Nov. 1966 23 p refs Previously Published in NASA SP-76: N66-10226 01-31
(NASA-TN-D-3665; NASA-SP-76) CFSTI: HC $1.00/MF $0.50 CSCL 04A

Solar cells on Relay I were monitored for radiation damage by measurement of short circuit current. The orbit was 1321 km perigee, 7439 km apogee, 47.5 degrees inclination. Unshielded N/P, P/N, and gallium arsenide cells degraded in 10 days to 52, 28, and 18 percent, respectively. This damage is ascribed to low energy protons. At 300 days, silicon N/P and P/N cells, shielded with 30 mils of fused silica, had degraded to 73 and 53 percent respectively. At 300 days, silicon N/P and P/N cells, shielded with 60 mils of fused silica, had degraded to 80 and 61 percent, respectively. Available space flux maps predicted somewhat greater damage to the heavily shielded cells, from either electrons or high energy protons, than that observed. The minority carrier lifetime of some 1N645 silicon diodes declined to 50 percent in about 45 days. Author

N66-39906*# Consultants and Designers, Inc., Arlington, Va.
SOLAR CORONA EMISSION IN THE SPECTRUM REGION λ < 10 Å [IZLUCHENIYE SOLNECHNOY KORONY V OBLASTI SPEKTRA KOROCHE 10 A]
E. P. Fetison 10 Jun. 1964 5 p refs Transl. into ENGLISH from Astron. Zh. (USSR), v. 41, no. 2, 1964 p 299-301
(Contract NAS5-2078)
(NASA-CR-79107; ST-SP-10153) CFSTI: HC $1.00/MF $0.50 CSCL 20H

The spectral emission flux of the corona in the λ<10 Å region has been determined theoretically. Considered are the line, recombination, and bremmstrahlung emissions. The continuous emission from heavy ion recombinations prevails. The theoretical flux is less than that observed, which is evidence of corona's high nonhomogeneity. Author

N66-39993*# Consultants and Designers, Inc., Arlington, Va.
ENERGY BALANCE OF COSMIC RAYS [ENERGETICHESKIY BALANS KOSMICHESKIKH LUCHEY]
I. L. Rozental' 3 Jun. 1966 11 p refs Transl. into ENGLISH from Astron. Zh. (Moscow), v. 43, no. 2, 1966 p 332-339
(Contract NAS5-9299)
(NASA-CR-79086; ST-CR-IGA-10486) CFSTI: HC $1.00/MF $0.50 CSCL 20H

The energy dissipation channels of the nuclear and electron components of cosmic rays in the Galaxy and Metagalaxy are analyzed. Definite forms of transition of energy, which is consumed on the ionization, are discussed. On the whole, the ionization energy is composed of slow-electron energy. The basic fraction of slow electron energy is expended on the excitation of interstellar hydrogen (mainly for the 1s-2p) transition, which is then exhausted). The further destiny of the ultraviolet is discussed. A fraction of energy of slow secondary electrons is spent on the formation of bremmstrahlung photons. A comparatively large fraction of energy in this intermediate mechanism is consumed for the formation of X-rays. Author

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N66-38835* Lockheed Missiles and Space Co., Huntsville, Ala.
RESEARCH IN STABILITY OF PERIODIC MOTIONS Quarterly Progress Report, 5 May-4 Aug. 1966
D. L. Hitzl and John White [1966] 17 p ref
(Contract NAS8-20323)
(NASA-CR-78675; LMSC/HREC-A783146) CFSTI: HC $1.00/MF $0.50 CSCL 03C

Background material is summarized as a basis for deriving exact analytical results concerning the degree of instability of certain periodic orbits in the restricted and reduced three-body problems. In establishing the existence of periodic solutions to the three-body problem, emphasis is placed on Poincare's fixed point method in which consecutive intersections of the solution with, in general, a hyperplane in phase space constitute a mapping of that hyperplane into itself. These periodic solutions are represented by fixed points in the mapping. A known periodic solution, which is not an equilibrium solution, is required; and the mapping is of one neighborhood onto another neighborhood of this fixed point. It is pointed out that the key to the existence of periodic solutions is that mapping is area-preserving, that is, the areas of the neighborhood of the fixed point and its image neighborhood are equal. The Liapunov and Dirichlet theorems on the stability of equilibrium solutions of a set of differential equations are discussed. N.A.S.

N66-38949*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
INTERPLANETARY MAGNETIC MEASUREMENTS
E. J. Smith, Leverett Davis, Jr. (Calif. Inst. of Tech., Pasadena), P. J. Coleman, Jr. (Calif. Univ., Los Angeles), and C. P. Sonett (NASA, Ames Res. Center) *In its* The Solar Wind 1966 p 35-52 refs (See N66-38946 24-29) CFSTI: HC $7.00/MF $2.00

A triaxial fluxgate magnetometer with three orthoganal sensors was used on Mariner-2 to gather information on the interplanetary magnetic field. Preliminary analysis of the data obtained revealed a large scale interplanetary field with characteristics similar to those expected on the basis of theory. The field tended to lie on the ecliptic and to make the expected spiral angle. The construction of the model that was used to derive these characteristics of the interplanetary field is discussed. H.S.W.

N66-38965*# Royal Inst. of Tech., Stockholm (Sweden).
ON THE OCCURRENCE OF TOPOLOGICAL CHANGES OF THE MAGNETOSPHERE
B. V. O. Sonnerup *In* JPL The Solar Wind 1966 p 275-280 refs (See N66-38946 24-29) CFSTI HC $7.00/MF $2.00

In a discussion of the topology of the magnetosphere, two configurations are considered, a closed magnetosphere and an open magnetosphere. It is stated that even in the presence of an interplanetary field, the closed character of the magnetosphere is preserved; however, the open configuration can be obtained if the interplanetary magnetic field in the vicinity of the magnetosphere

is antiparallel to the terrestrial field in the equatorial plane. The question of the actual occurrence of these two geometries is examined. The main phase of the magnetic storm is considered to be the result of a transition from the closed to the open magnetosphere. A mechanism is discussed that may explain this process. H.S.W.

N66-38968*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OBSERVATIONS OF THE MAGNETIC FIELD AT THE MAGNETOPAUSE AND INTERACTION REGION BY IMP-1
N. F. Ness *In* JPL The Solar Wind 1966 p 315–335 refs (See N66-38946 24-29) CFSTI: HC $7.00/MF $2.00

Magnetic field data are presented for the first 19 orbits of IMP I satellite. Data from outbound and inbound passes of orbits 11 and 6 and outbound pass of orbit 15 are included. The distances to the magnetopause and shock-wave boundary crossings are plotted. Other figures show the Newtonian approximation of the solar wind interaction with the geomagnetic field, the Alfvén velocity as a function of particle density, the theoretical ratio of the shock wave stand-off distance to the magnetosphere boundary distance as a function of Mach number, and correlation of the magnetic field data with plasma data. Conclusions are that there is a shock wave associated with the solar plasma flow around the Earth and its magnetic field, and that this shock wave can be understood on the basis of an aerodynamic analogy. S.P.

N66-38969*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE SHAPE OF THE MAGNETOSPHERE AND THE DISTORTION OF THE GEOMAGNETIC FIELD
Gilbert D. Mead *In* JPL The Solar Wind 1966 p 337–352 refs (See N66-38946 24-29) CFSTI: HC $7.00/MF $2.00

The Newtonian approach is used, in contrast to the fluid dynamic approach, to calculate the magnetic field inside the magnetopause. It is assumed that the magnetosphere is closed and that the magnetopause (not the shock wave) is determined by a balance between the magnetic pressure inside the boundary and a plasma pressure outside. The shape of the magnetosphere as determined by applying the pressure balance condition at 5-deg intervals on the surface is illustrated, and a view of the calculated magnetopause from the Sun is included. Plots are presented for the magnitude of the distorted field as compared with the undisturbed dipole field in the equatorial plane, and at latitudes of 30 and 60 deg north. Also shown is the configuration of the distorted field compared with the undisturbed dipole field in the plane of the noon meridian. It is demonstrated that the Newtonian approach permits specific calculations of the distortion of the field. S.P.

N66-38986# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COSMIC RESEARCH, VOLUME III, No. 6, 1965
[1966] 236 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 3, no. 6, 1965 p 811–952
(FTD-TT-65-1985; TT-66-61930; AD-636619) CFSTI: HC $6.00/MF $1.25

CONTENTS:

1. OPTIMUM ACCELERATION OF THE SPACE VEHICLE IN A CENTRAL FIELD G. V. Yefimov and D. Ye. Okhotsimskiy p 1–23 refs (See N66-38987 24-30)

2. OPTIMUM DISTRIBUTION OF CORRECTING PULSES IN SINGLE-PARAMETER CORRECTION. I V. A. Yaroshevskiy and G. V. Parysheva p 24–42 refs (See N66-38988 24-30)

3. CERTAIN PROPERTIES OF THE LINEARIZED SYSTEM OF EQUATIONS OF PERTURBED MOTION AND THEIR APPLICATION TO THE MOTION OF THE MASS CENTER OF A SPACE VEHICLE V. I. Charnyy p 43–65 refs (See N66-38989 24-30)

4. DYNAMICS OF THE GEOMAGNETIC TRAP, II V. D. Pletnev, G. A. Skuridin, and L. S. Chesalin p 66–107 refs (See N66-38990 24-30)

5. ELECTRON AND ION TEMPERATURES IN THE IONOSPHERE T. K. Breus and G. L. Gdalevich p 108–133 refs (See N66-38991 24-13)

6. DISTRIBUTION OF ELECTRONS WITH E > 40 KeV BY PITCH ANGLES IN INNER BELT ACCORDING TO DATA FROM KOSMOS 5 SATELLITE O. L. Vaysberg and F. K. Shuyskaya p 134–153 refs (See N66-38992 24-29)

7. CERTAIN QUESTIONS REGARDING PUNCTURE ON COLLISION WITH METEORIC PARTICLES Yu. S. Stepanov p 154–176 refs (See N66-38993 24-30)

8. THE NATURE OF RADIO NOISE EMISSION FROM THE SURFACE OF VENUS V. M. Vakhnin and A. I. Lebedinskiy p 177–197 refs (See N66-38994 24-29)

9. APPLICATION OF CORRELATION ANALYSIS METHODS TO STUDY OF THE REACTIONS OF THE HUMAN CARDIOVASCULAR SYSTEM IN SPACE FLIGHT ABOARD A "VOSKHOD" VEHICLE A. D. Voskresenskiy and M. D. Venttsel' p 198–211 refs (See N66-38995 24-04)

10. INVESTIGATION OF KIDNEY FUNCTION IN THE CREW OF A "VOSKHOD" SPACECRAFT Yu. V. Natochin, M. M. Sokolova, V. F. Vasil'yeva, and I. S. Balakhovskiy p 212–219 refs (See N66-38996 24-04)

11. ORIENTATION OF MAN IN SPACE A. A. Leonov and V. I. Lebedev p 220–232 refs (See N66-38997 24-05)

N66-38987# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OPTIMUM ACCELERATION OF THE SPACE VEHICLE IN A CENTRAL FIELD
G. V. Yefimov and D. Ye. Okhotsimskiy *In its* Cosmic Res., Vol. III, No. 6 [1966] p 1–23 refs (See N66-38986 24-30) CFSTI: HC $6.00/MF $1.25

Considered is the variational problem of optimum acceleration of a space vehicle with small thrust, starting from a nearly circular orbit and accelerating to hyperbolic velocity. The laws governing optimum motion are investigated. A comparison is drawn with motion under the action of a constant tangential acceleration. Considerations are presented pertaining to the construction of the limit solution of the variational problem, calculation of which would make it possible to reduce evaluation of the main parameters of optimum acceleration to the use of single-entry tables or calculation by finite formulas. Author

N66-38988# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OPTIMUM DISTRIBUTION OF CORRECTING PULSES IN SINGLE-PARAMETER CORRECTION, I
V. A. Yaroshevskiy and G. V. Parysheva *In its* Cosmic Res., Vol. III, No. 6 [1966] p 24–42 refs (See N66-38986 24-30) CFSTI: HC $6.00/MF $1.25

The linear problem of single-parameter correction is considered. Relationships are derived to determine the mathematical-expectation minimum expenditure for correction under the condition of ideally generated pulses, with all perturbations and measurement errors normally distributed. The problem of selecting a control strategy that minimizes the mathematical-expectation of the working-fluid expenditure is examined. A comparison is made between discontinuous and continuous correction for elementary model problems. K.W.

N66-38989# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CERTAIN PROPERTIES OF THE LINEARIZED SYSTEM OF EQUATIONS OF PERTURBED MOTION AND THEIR APPLICATION TO THE MOTION OF THE MASS CENTER OF A SPACE VEHICLE

V. I. Charnyy *In its* Cosmic Res., Vol. III, No. 6 [1966] p 43-65 refs (See N66-38986 24-30) CFSTI: HC $6.00/MF $1.25

Investigated were the properties of the system of variational equations and the conjugate system of equations for dynamic systems, which describe the perturbation influence functions as they depend on reference-trajectory parameters. The results obtained in this study for general dynamic systems enable us to derive relationships for the fundamental and correlation matrices of the deviations of the space-vehicle mass-center motion parameters. In many cases, the properties obtained for partial solutions of the conjugate system and the variational system enable us to conduct partial or complete integration of the system of linearized equations of motion. Author

N66-38990# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DYNAMICS OF THE GEOMAGNETIC TRAP, II

V. D. Pletnev, G. A. Skuridin, and L. S. Chesalin *In its* Cosmic Res., Vol. III, no. 6 [1966] p 66-107 refs (See N66-38986 24-30) CFSTI: HC $6.00/MF $1.25

In continuation of the survey paper this part examines the various hypotheses concerning the formation of the magnetosphere boundary. Particular attention is devoted to the so-called neutral points on the day and night sides (near the equatorial plane), and to the possibility of charged particles of the solar stream being pulled into the magnetosphere both through the neutral points and by direct crossing of the boundary layer. The study also considers the structure of the stationary geomagnetic field at great distances from the earth. The theoretical conclusions are compared with experimental data, primarily those set forth in the first part of the survey, with some reference to those of the second part. Author

N66-38993# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CERTAIN QUESTIONS REGARDING PUNCTURE ON COLLISION WITH METEORIC PARTICLES

Yu. S. Stepanov *In its* Cosmic Res., Vol. III, no. 6 [1966] p 154-176 refs (See N66-38986 24-30) CFSTI: HC $6.00/MF $1.25

The curve of the ratio of maximum obstacle puncture thickness to crater depth is studied as a function of collision velocity. Maximum penetration thicknesses are calculated for several particle-obstacle pairs up to impact velocities $v_0 \sim 100$ km·sec^{-1} on the basis of experimental determination of a series of physical parameters figuring in theoretical evaluations. Puncture of several obstacles by a nondeforming particle is considered, and certain assumptions are adopted to evaluate puncture of a second obstacle by a deformed particle and a spray of fragments. On the basis of the solution obtained and information from rocket probes and artificial earth satellites, the annual surface attrition due to bombardment by meteoric particles at various heights above the earth is estimated. Author

N66-39332*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.

FIRST-ORDER ANALYSIS OF SUNBLAZER ORBITS

John V. Harrington Oct. 1966 22 p

(Contract NASr-249)

(NASA-CR-78751; CSR-TR-66-10) CFSTI: HC $1.00/MF $0.50 CSCL 22C

The heliocentric orbit of the Sunblazer space probe satellite is reported. Mathematical models are presented for the circular orbital velocity relationship to the perehelion distance, and the escape velocity at burnout altitude. Tabular data indicate orbital parameters for both retrograde and direct launching of solar satellites, as well as orbital periods for superior conjunction on lines of apses. The most desirable orbit for the Sunblazer heliocentric satellite is precisely stated. R.LI.

N66-39388*# California Univ., San Diego.

INFRARED CONTINUUM FROM HII REGIONS

Wayne A. Stein 13 Sep. 1966 11 p refs

(Grants NsG 318; NsG 357)

(NASA-CR-78767) CFSTI: HC $1.00/MF $0.50 CSCL 03B

Estimated projected infrared free-free emission values for continuum radiation processes in the HII regions showed that infrared flux should be detectable from some planetaries at the shorter wavelength of 3 or 5 microns. Calculations on expected infrared free-free emission from five of the brightest small planetaries were made, based on observed $H\beta$ free-free were made and are presented graphically for wavelengths from 3 microns to 1mm. Also listed are values for the expected flux from the Orion nebula, and the expected flux from the thermal source in the Galactic nucleus. It was concluded that infrared emission measurements on planetary nebulae at wavelengths greater than 3μ offer an alternative checking method for the recombination theory of visible light from planetary sources. G.G.

N66-39400*# Eidgenossische Technische Hochschule, Zurich (Switzerland).

ANALYTICAL FLOW THEORY IN THE THREE BODIES PROBLEM WITH THE USE OF REGULARIZING VARIABLES [ANALYTISCHE STOERUNGSTHEORIE IM DREIKOERPER-PROBLEM MIT HILFE VON REGULARISIERENDEN VARIABLEN]

Max Roessler (Ph.D. Thesis) 1966 77 p refs In GERMAN *Its* Rept.-3772

(Grant NGR-52-056-001)

(NASA-CR-78759) CFSTI: HC $3.00/MF $0.75 CSCL 03C

Fourier series transformations were used in the perturbation analysis of a spatial three-body problem where the mass of the central, fixed body was known, and where the moving body and the disturbing body followed the Newton gravity law and remained in undisturbed Keplerian orbits. Example calculations on the perturbation of the planet Vesta by the Planet Jupiter showed good agreement with established results. Transl. by G.G.

N66-39401*# Eidgenossische Technische Hochschule, Zurich (Switzerland).

GENERALIZATION OF THE BIRKHOFF REGULARIZATION OF THE THREE SPACE BODIES PROBLEM [DIE VERALLGEMEINERUNG DER BIRKHOFF-REGULARISIERUNG FUER DAS RAEUMLICHE DREIKOERPERPROBLEM]

J. Waldvogel (Ph.D. Thesis) 1966 90 p refs In GERMAN *Its* Diss.-3816

(Grant NGR-52-056-001)

(NASA-CR-78758) CFSTI: HC $3.00/MF $0.75 CSCL 03C

Spinor regularization of the three-dimensional Kepler motion was used to construct a restricted, spatial three-body model, from a four-dimensional space. Extension of the corresponding differential ninth order equation system to the tenth order made it possible to regulate also the elliptical restricted three-body problem. Transl. by G.G.

N66-39434# Library of Congress, Washington, D. C. Aerospace Technology Div.

LUNAR DIMENSIONS—ANNOTATED BIBLIOGRAPHY Surveys of Foreign Scientific and Technical Literature

Joseph Javis and Daniel W. Michaels 5 Aug. 1966 26 p refs (ATD-B-66-96)

This annotated bibliography was compiled from Soviet open sources published 1964-1966 and one Chicom open source published in 1965. It is the second in a series and it reflects Soviet developments from about mid-1965 in investigating lunar revolution, rotation, libration, and mapping techniques. Pertinent information included: velocity profile of the Moon, libration effect based on meridian observations of lunar diameters in Greenwich in

1900–1954, determination of the equinox correction from lunar observations by Newcomb's method, methods for computing the ephemerides of the Moon, lunar polygonometry technique, determination of the constants of lunar libration, theory of physical libration of the Moon, diurnal rotation of planets, gravity and shape of the Moon, lunar measuring equipment. Author

N66-39520# Aeronautical Chart and Information Center, St. Louis, Mo.
CARTOGRAPHIC REDUCTION OF RANGER VIII AND IX MISSIONS
Jul. 1966 10 p refs
(ACIC-TP-21; AD-637186) CFSTI: HC $1.00/MF $0.50

A series of charts were developed using photographs and other data derived from the Ranger VIII and IX missions. The paper discusses the characteristics of this data and its reduction to cartographic form. (The charts are not included as part of the publications.) (Author) TAB

N66-39579# RAND Corp., Santa Monica, Calif.
MANNED SATELLITE OBSERVATIONS AND PLANETARY RESEARCH
D. Deirmendjian Aug. 1966 12 p refs Presented at the 17th Intern. Astron. Congr., Madrid, 9–15 Oct. 1966
(P-3418; AD-637780) CFSTI: HC $1.00/MF $0.50

Certain terrestrial observations from a manned geophysical satellite are considered as a training ground for research on other planets. In particular, it is shown that the experience thus acquired is essential in solving some of the outstanding problems of the Venusian atmosphere by means of a properly designed flyby mission to that planet Author (TAB)

N66-39705*# Illinois Univ., Urbana. Coordinated Science Lab.
THE EFFECTS OF THE NODAL REGRESSION OF THE ORBIT ON THE GRAVITY PRECESSION OF A GYROSCOPIC SATELLITE
James L. Myers, Jr. Jul. 1966 27 p refs
(Grant NsG-443; Contract DA-28-043-AMC-00073(E))
(NASA-CR-78875; R-309) CFSTI: HC $2.00/MF $0.50 CSCL 22C

A gyroscopic satellite has been proposed for a test of the general theory of relativity in which the gyro drift rate to be measured is less than seven seconds of arc per year. A simple passive gyroscope has been proposed which uses sunlight reflected from mirrors to provide optical data to determine the spin axis orientation. The gravity gradient torque acting on the satellite is one of several extraneous disturbances which can cause spurious precission of the gyro spin axis. General equations for the precession of a gyro satellite in a regressing orbit are derived. These equations may be used to specify the tolerances for initial spin axis and orbit alignments which enable an accurate measurement of the relativity effect. Author (TAB)

N66-39706*# Brown Engineering Co., Inc., Huntsville, Ala. Space Vehicle Div.
EFFECTS OF LIQUID SLOSH ON RENDEZVOUS DYNAMICS
J. H. Dobkins and T. W. Smith 31 Dec. 1965 44 p refs
(Contract NAS8-20073)
(NASA-CR-78975) CFSTI: HC $2.00/MF $0.50 CSCL 22A

A mathematical model is presented for investigation of the effects of liquid slosh on rendezvous dynamics. The Euler–Lagrange formulation was used to describe the motions of the carrier and target vehicles. The slosh dynamics were simulated by two pendulums in the vehicle. The sophisticated nature of this mathematical model is ideal for control and guidance system studies, and permits constant monitoring of propellant usage. A study of low-gravity bubble dynamics is included. This study presents interesting possibilities for removal of liquid slosh during critical periods. Author

N66-39723*# Stanford Univ., Calif. Radioscience Lab.
RESEARCH AT THE STANFORD CENTER FOR RADAR ASTRONOMY Semiannual Status Report No. 7, 1 Jan.–31 Jun. 1966
Aug. 1966 18 p refs
(Grant NsG-377)
(NASA-CR-78946) CFSTI: HC $1.00/MF $0.50 CSCL 03B

Summary reports are given on continuing research in radio and radar studies of space plasmas and spacecraft instrumentation, including monostatic radar astronomy, planetary surface mapping, planetary atmospheres and ionospheres, sun echoes, ionospheric disturbances, signal channel coding schemes, spacecraft receiving techniques, and spacecraft orientation. A list of publications, scientific reports, and papers presented is also included. L.E.W.

N66-39838 Utrecht Observatory (Netherlands).
THE SPECTRUM OF 10 LACERTAE
Anne B. Underhill and Mart De Groot 1965 71 p refs *Its* Vol. XVII, No. 3

The results of an observational study of the star 10 Lacertae are presented. It is noted that when the spectra of early stars of a given spectral type are examined at high dispersion, each star is found to be rather rather different from other stars of the same spectral type. The measured wavelengths and equivalent widths are presented, and the methods of obtaining these data and the systems of weighting are explained. The observational material which was studied is described, and comments are made regarding the various atomic and ionic spectra that may be present. H.S.W.

N66-39845# Osservatorio Astronomico di Roma (Italy).
SOLAR PHENOMENA
Massimo Cimino Jul. 1966 13 p *Its* Monthly Bull. No. 103
CFSTI: HC $1.00/MF $0.50

Tabulated data from observations of sunspot activity are presented. The data include daily total areas of sunspot groups; heliographic position, classification and area of sunspot groups; and, charts showing longitudinal sunspot magnetic fields. H.S.W.

N66-39894*# United Aircraft Corp., East Hartford, Conn.
MINIMUM-IMPULSE TIME-FREE TRANSFER BETWEEN ELLIPTIC ORBITS
Frank W. Gobetz, Michael Washington, and Theodore N. Edelbaum Washington, NASA, Nov. 1966 110 p refs
(Contract NAS1-4688)
(NASA-CR-636) CFSTI: HC $3.00/MF $0.75 CSCL 22C

Minimum-impulse orbit transfer between coplanar ellipses and between neighboring low-ecentricity elipses was investigated. In the former case, all optimal elliptic transfer arcs were isolated and cataloged, and a graphical method for determining the optimal transfer between arbitrary coplanar ellipses was presented. In the latter case, explicit relations were derived for the optimal transfer between adjacent ellipses whose elements are known. Author

N66-39914*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
ANOMALOUS OH ABSORPTION IN THE DIRECTION OF CASSIOPEIA A
A. E. E. Rogers and A. H. Barrett [1966] 13 p refs Presented at the IAU/URSI Symp. on Radio Astronomy and Galactic Systems, Noorwijk, Netherlands, 24 Aug.–1 Sep. 1966 Submitted for Publication
(Grant NsG-419)
(NASA-CR-79118) CFSTI: HC $1.00/MF $0.50 CSCL 03B

A series of high frequency resolution absorption observations were made in the direction of Cassiopeia A in an effort to overcome discrepancies in previously reported values (5 kc/s) of OH absorption line rest frequencies. The −0.8 km/s absorption

line in Cas A was well split into two components at both 1665 and 1667 Mc/s. The line ratios were in the ratio 5:9, within the noise limitations of the observations, and agreed with previous observations of these two lines. Neither the 1612 nor the 1720 Mc/s lines showed the splitting. The presence of large absorption at 1612 Mc/s and reduced absorption, or emission, at 1720 Mc/s is analyzed theoretically by considering energy level populations. S.C.W.

N66-39921*# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
MINIMUM-FUEL ATTITUDE CONTROL OF A RIGID BODY IN ORBIT BY AN EXTENDED METHOD OF STEEPEST-DESCENT
K. A. Hales and I. Fluegge-Lotz Jan. 1966 145 p refs
(Grant NsG-133-61)
(NASA-CR-79112; SUDAAR-257) CFSTI: HC $4.00/MF $1.25 CSCL 22A

An extended method of steepest descent was used to solve the minimum fuel optimization problem for two nonlinear, sixth-order mathematical models; and to generate approximately optimal trajectories for the spacecraft attitude acquisition problem. The state trajectories generated by this method are compared with those generated by an idealized 3 axis proportional state feedback control system. It was found that trajectories generated by the former technique consumed less fuel, acquired the desired orientation more quickly, and used lower control torque magnitudes than those required by the feedback scheme. A comparison is found between trajectories generated by steepest-descent and true optimal trajectories. The extended method of steepest-descent was found to provide similar trajectories which satisfy the terminal constraints while using as much as 15% more fuel than optimal. It is concluded that a primary contribution of this method is that it can be used to generate a set of nearly optimal state trajectories, starting from a finite set of arbitrary initial conditions, which may be used as design goals for sub-optimal acquisition control schemes. S.C.W.

N66-39937*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE SOVIET CHALLENGE IN SPACE
Charles S. Sheldon 15 Sep. 1966 22 p
(NASA-TM-X-53518) CFSTI: HC $1.00/MF $0.50 CSCL 22A

Comparisons are drawn between the United States and the Soviet space programs, with little difference found between the goals of each country. Although the number of successful flights of payloads to earth orbit or escape is estimated at 2.1 to 1 in our favor, it is also pointed out that the Soviets still maintain the lead in total weight of payload. No significant statistical differences between the two countries are noted in the records of successes and failures. The U. S. scientific satellite program is considered stronger, but Soviet commitments in unmanned lunar and planetary flights are estimated as 15 times larger than ours. The United States superiority in developing applications satellites is reviewed, along with Soviet weather, communications, and navigation programs. The military uses of space are discussed in relation to national policies, and the view is offered that the Soviets used their Kosmos satellites as a cover for many kinds of activities. In rocket thrust technology, the two countries are considered at a parallel level. Soviet manned space flight achievements are summarized, and no prediction is ventured as to who will win the race to the moon. M.G.J.

N66-39949*# National Aeronautics and Space Administration, Washington, D. C.
ECLIPSE WILL BE PHOTOGRAPHED FROM SPACE
31 Oct. 1966 10 p
(NASA News Release-66-285) Available from the Scientific and Technical Information Division CSCL 03B

The rocket borne, Gemini 12, jet transport, and Nimbus II experiments to be conducted during the total solar eclipse over South America on November 12, 1966 are described. The activities are to be conducted by NASA in cooperation with scientists of Argentina and Brazil as part of an international program. Included are details of the Argentina–U.S. and Brazil eclipse studies and their respective sounding rocket experiments which will measure characteristics and properties of the upper atmosphere and ionosphere; the jet transport research laboratory and its experiments and investigators; and Nimbus II's picture taking sequence of the eclipse area. R.N.A.

N66-39959*# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A STUDY OF THE DEPOLARIZATION OF LUNAR RADAR ECHOES
Tor Hagfors [1966] 49 p refs
(Contract NSR-22-009-106)
(NASA-CR-79098) CFSTI: HC $2.00/MF $0.50 CSCL 03B

The radar backscattering characteristics of the lunar surface are examined in detail at a wavelength of 23 cm. The backscattered waves are studied both for circular and for linear polarization of the transmitted wave. Effects relating to the orientation of the local plane of incidence on the moon with respect to the polarization of transmitted or scattered waves are investigated. The experimental results appear to support strongly the hypothesis that the returns at oblique angles of incidence arise through single scattering from discrete objects as opposed to the returns at near normal incidence which are dominated by quasispecular reflection. Author

N66-39962# General Electric Co., Philadelphia, Pa. Missile and Space Div.
FURTHER STATISTICAL EVIDENCE FOR ASSUMING THAT THE PLANET MERCURY HAS A MAGNETIC FIELD
R. C. Good, Jr. Jul. 1966 22 p refs Supersedes R66SD8; see N[illegible]-26946 15-29
(R66SD42; R66SD8; AD-487031)

The heliographic longitude of the planet Mercury has been noted for each solar proton event recorded on Earth. Wehn compared with the heliographic longitude of the attending solar flares 14 (instead of the average 6) out of the 30 events occurred when Mercury was within 40 degrees. This phenomenon is taken to indicate that a magnetic field about the planet Mercury may influence the solar flare proton trajectories to increase the flux striking the Earth. The deflection angle required for the protons to be turned towards Earth are not large (60–80 degrees). Comparable data for Venus indicate it was not close to the flares and would require a large deflection in proton trajectories. Author (TAB)

N66-39967*# General Electric Co., Philadelphia, Pa. Space Sciences Lab.
MINIMUM-FUEL, TWO-IMPULSE, SOFT LUNAR LANDING ORBITS
Carlos R. Cavoti Sep. 1966 44 p refs
(Contract NAS9-5550)
(NASA-CR-65554) CFSTI: HC $2.00/MF $0.50 CSCL 22C

The problem of minimum-fuel-consumption soft lunar landing trajectories is here considered. The trajectories discussed involve two impulses. The boundary conditions are arbitrary. Practical closed-form expressions for the impulse conditions of useful geometrical meaning are derived. Such expressions are particularly suitable for the formulation of the optimum problem using the method of undetermined Lagrange multipliers. The necessary conditions for a minimum-fuel-consumption soft lunar are derived for both free-range and given-range problems. The method of numerical solution and several applications are discussed. The basic characteristics of the landing trajectories are analyzed using the expressions derived. Numerical solution shows that, among all the free-range optimum trajectories starting at different points on a given eliptical orbit around the moon, the trajectory starting with a tangential retro-impulse at the apogee affords an absolute

minimum fuel consumption. Due to the boundary conditions imposed, a theoretical analysis shows that the transfer orbit can not be of the Hohmann type. Although, depending on the initial orbit assumed, the transfer may closely approximate the Hohmann type.
Author

N66-39978*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
HIGH-ALTITUDE ATMOSPHERIC MEASUREMENTS FOR THE REENTRIES OF GEMINI 6 AND GEMINI 7
David E. Pitts and Patricia C. Carter Nov. 1966 78 p refs
(NASA-TM-X-58003) CFSTI: HC $2.50/MF $0.75 CSCL 22C

The atmospheric wind, density, pressure, temperature, and speed of sound are reported for the reentries of Gemini 6, and for Gemini 7. Sources of the data were: arcasondes at Cape Kennedy and Grand Turk Island; a Nike-Cajun falling sphere at Eglin Air Force Base; and rawinsondes at Cape Kennedy and at the three islands—Grand Turk, Eleuthera, and Grand Bahama. Vertical extrapolations were used to extend the arcasonde data above 160,000 feet. Horizontal extrapolations were used to determine the atmospheric quantities along the reentry ground track. Comparisons of the atmospheric winds, as measured by the arcasonde parachute and the falling sphere, showed remarkable agreement. Above 70 kilometers, the density structure, as recorded by means of the falling sphere, showed reasonable agreement with the extrapolation of the arcasonde; below 70 kilometers, more disagreement was noted.
Author

N66-39983*# Michigan Univ., Ann Arbor.
ON OPTIMUM TRANSFER BETWEEN TWO TERMINAL POINTS FOR MINIMUM INITIAL IMPULSE UNDER AN ARBITRARY INITIAL VELOCITY VECTOR
Fang Toh Sun Washington, NASA, Nov. 1966 99 p refs
(Grant NsG-558)
(NASA-CR-622) CFSTI: HC $2.50/MF $0.75 CSCL 22C

The problem of minimizing the initial impulse required for the transfer between two terminal points in space under an arbitrarily prescribed initial velocity vector is analytically investigated. The chordal and radial components of the in-plane velocity are introduced, and a geometrical approach in the hodograph space is employed. In terms of these velocity coordinates Stark's optimum quartic equation is reformulated and critically examined for the number and nature of its real solutions. Analytical criteria for the unrealistic optimum are derived, and the selection of a realistic transfer trajectory under various conditions of the initial velocity vector is discussed and summarized in some simple rules. Various regions in the hodograph plane concerning the nature of the optimum transfer trajectory are analyzed. An optimization chart is developed, and the construction of two versions of the optimum transfer hodograph are introduced. Several limiting cases including the vertical transfer, the 180° transfer, and the transfer to infinity are investigated, and the particular case of departure from a circular orbit is also reviewed.
Author

N66-39991*# American Science and Engineering, Inc., Cambridge, Mass.
A PROGRAM OF X-RAY ASTRONOMY FROM SOUNDING ROCKET Final Report
H. Gursky, R. Giacconi, P. Gorenstein, and J. R. Waters [1966] 97 p refs
(Contract NASw-1284)
(NASA-CR-79097; ASE-1372) CFSTI: HC $3.00/MF $0.75 CSCL 03B

The work performed during this program resulted in the flight of scientific payloads on two Aerobee rockets, numbers 4.147 and 4.148. As a result of data obtained during these flights, it has been possible to locate the visible counterpart of ScoX-1, the bright X-ray source in Scorpio. This result may be sufficient to solve the problem of the nature of some of the galactic X-ray sources. The visible object is bright (12^{th} mag) and has many of the properties associated with old novae.
Author

N66-39994*# Consultants and Designers, Inc., Arlington, Va.
ON THE INAPPLICABILITY OF THE BALDWIN CORRELATION FOR THE DETERMINATION OF THE CAUSES OF EMERGENCE OF LUNAR CRATERS [O NEPRIMENIMOSTI SOOTNOSHENIYA BOLDUNA DLYA OPREDELENIYA PRICHIN VOZNIKNOVENIYA LUNNYKH KRATEROV]
G. S. Shteinberg 22 Dec. 1965 6 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR, Astron. (Moscow), v. 165, no. 1, 1965 p 55–57
(Contract NAS5-3760)
(NASA-CR-79089; ST-LPS-10431) CFSTI: HC $1.00/MF $0.50 CSCL 03B

Comparing the results of research by other authors with some observations of volcanic craters after aerial photographs taken in eastern volcanic belt, the present author points to the necessity of detailed morphological analysis of the latest data on lunar objects, comparing them with meteoritic and volcanic forms, since any alternate approach to causes having conditioned the formation of lunar relief does not allow a satisfactory explanation of all the facts observed. The author states that the "single-eventness" in the formation of meteoritic forms, and the duration and phase multiplicity of volcanic activity, must unconditionally, find reflection in the morphology of craters.
Author

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N66-38862*# United Aircraft Corp., East Hartford, Conn. Research Labs.
STUDY OF LOW-ACCELERATION SPACE TRANSPORTATION SYSTEMS Technical Report, Jul. 1964–Jun. 1965
R. V. Ragsac et al Jun. 1966 344 p refs
(Contract NAS8-11309)
(NASA-CR-78667; E-910262, Vol. II) CFSTI: HC $7.00/MF $1.75 CSCL 22B

Presented are results of a study designed to determine whether a useful manned mission to Mars could be accomplished during the 1980 time period utilizing high- and low-thrust propulsion systems in combination. The principal objective was to investigate means for minimizing the vehicle mass placed on Earth parking orbit. Summarized are major accomplishments of mission analysis and requirements studies; flight profile studies; trajectory analyses; power systems studied; and studies of earth entry and life support systems. Also included are data on research and technology implications, and study areas recommended for the future analysis of manned interplanetary hybrid-thrust missions.
S.C.W.

N66-38919*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
ELECTRICALLY-PROPELLED CARGO VEHICLE FOR SUSTAINED LUNAR SUPPLY OPERATIONS Summary Report
24 Jun. 1966 120 p refs
(Contract NAS8-11207)
(NASA-CR-78680; GE-66SD2019) CFSTI: HC $4.00/MF $1.00 CSCL 22B

In considering the operational pattern for logistic material support of lunar operations, attention was focused on the transfer

from earth orbit to lunar orbit. The ascent from earth to orbit is assumed to be accomplished by the Saturn V; the descent from orbit to the lunar surface, by a single-use, oxygen–hydrogen propelled vehicle. Several variations of the operational mode are identified and compared, and requirements are determined for both continuous propulsion (characteristic for nuclear power sources) and discontinuous propulsion (characteristic for solar power sources). The net power output of various nuclear powerplants sized at 11,300 kg total mass is compared. A mission comparison was performed between the various nuclear and solar powerplants on a consistent set of assumptions, and the results are summarized. Also presented are the results of a detailed trajectory analysis which was conducted to determine the differences in propulsion requirement and trip time between nuclear systems with continuous power and solar systems with discontinuous power due to the earth shadow effect. M.G.J.

N66-38923*# Bendix Corp., South Bend, Ind. Bendix Products Aerospace Div.

DEVELOPMENT OF A MATHEMATICAL ANALYSIS FOR PREDICTING THE DYNAMIC BEHAVIOR OF THE APOLLO COMMAND MODULE DURING EARTH LANDING Final Report, 7 Jul. 1965–16 May 1966

R. J. Black. 15 Sep. 1966. 447 p. Revised.
(Contract NAS9-4511)
(NASA-CR-65535; MM-66-15) CFSTI: HC $7.46/MF $2.25
CSCL 22A

Development and features of a computerized mathematical analysis of the Apollo command module for earth landing studies are described. A three mass approach is used to study shock-mounted, deployed heat shields and shock attenuation systems of the astronauts's couch and capsule power. A wedge theory of soil elastoplastic characteristics is used to define the reaction force between the crushable surface of the module and the deformed soil surface. Parachute force effects and retrorocket systems for the command module can also be studied through this program. A variety of landings, both planar and nonplanar, on hard surfaces, clay and silica sand were used to obtain experimental verification of the program. The computer program is written in Fortran language. G.G.

N66-38952*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Med.

INTERPLANETARY MAGNETIC-FIELD MEASUREMENTS BY THE IMP-1 SATELLITE

N. F. Ness. *In* JPL The Solar Wind 1966 p 83–107 refs (See N66-38946 24-29) CFSTI: HC $7.00/MF $2.00

A discussion of the Interplanetary Monitoring Platform identifies the features that are directly related to the experiments conducted to investigate interplanetary magnetic fields, and magnetic storms. A description of the major instruments is included and the sequences used to obtain the data are outlined. The characteristics of IMP-1's orbit are examined and the value of a highly elliptical orbit is assessed. In summarizing the interplanetary field data, it is suggested that evidence is given that the general filamentary structure strongly reflects the continuous expansion of the solar corona; this is in agreement with the theoretical models. The data dealing with magnetic storms is also discussed. The propagation velocity of the first disturbance of the storm observed was approximately 700 km/sec. This velocity is in agreement with energies of plasma associated with magnetic storms as measured by other satellites. It is also pointed out that there were neutral surfaces associated with the storm front. H.S.W.

N66-39066*# National Aeronautics and Space Administration, Washington, D. C.

GEMINI FINALE 98-HOUR FLIGHT BEGINS NOVEMBER 9

3 Nov. 1966. 68 p.
(NASA News Release 66-272) Available from Office of Scientific and Technical Information Division. CSCL 22B

A detailed description of the final Gemini manned space flight, Gemini 12, is presented. The flight tracking network is described with regard to mission requirements, real time computer complex, ground communications, and network responsibility and configuration. The mission plan and experiments aboard the spacecraft are summarized. Other topics discussed are abort and recovery, crew provisions and training, crew biographies, and previous Gemini flights. S.P.

N66-39253# Research Inst. of National Defence, Stockholm (Sweden). Uppsala Ionospheric Obs.

DEVELOPMENT AND CONSTRUCTION OF GERDIEN CONDENSER ROCKET PROBES

A. Pedersen and B. Oeberg. *In its* Rocket Expt. for Studies of D-Region Ion Concentration and Emission from Released Chem. in Twilight and Aurora 1966 p 33–45 refs (See N66-39251 24-13)

The mechanical construction of two different types of Gerdien condenser rocket probes and their instrumentation racks is described. The probes descend in inflatable parachutes after expulsion from Booster Arcas rockets between 80 and 90 km. The electronic circuits including electrometer, amplifiers and commutator units for driving voltage sweeps and for operation of switches are also described in some detail. The packing of units and procedure before launch is mentioned. Instrumentation rack temperatures were measured during four experiments, and temperature increases of the order of 20°C were found. Author

N66-39422*# National Aeronautics and and Space Administration, Langley Research Center, Langley Station, Va.

THE RELATIONS BETWEEN EXPERIMENT REQUIREMENTS, ENVIRONMENTS, AND SPACECRAFT DESIGN

Robert A. Bruce [1966] 35 p. Presented at Bio-Space Technol. Training Program, Wallops Island, Va., Aug. 1966
(NASA-TM-X-57996) CFSTI: HC $2.00/MF $0.50 CSCL 22B

A hypothetical biological experiment is proposed to illustrate the relation and compatibility between experiment and spacecraft design. An experimental flight of 3-months duration with two squirrel monkeys is proposed for improved understanding of effects of prolonged weightlessness. After establishment of the experiment concept, progressive steps are delineated. Experiment requirements are considered; functions of such systems as environmental control, life support, power, and attitude control are determined. Next in succession are selecting optimum subsystems, making preliminary weight estimates, selecting a booster for the desired orbit, and considering payload and reentry environments. After these requirements and environments are established, the detailed experiment design can be achieved. S.P.

N66-39536*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

OPERATIONAL EXPERIENCE WITH THE ELECTRONIC FLIGHT CONTROL SYSTEMS OF A LUNAR-LANDING RESEARCH VEHICLE

Calvin R. Jarvis. Washington, NASA, Oct. 1966. 45 p. refs
(NASA-TN-D-3689) CFSTI: HC $2.00/MF $0.50 CSCL 22B

The electronic flight control systems of a free-flight lunar-landing research vehicle have enabled the craft to provide meaningful research information on pilot-controlled landings in a pseudolunar environment. The lunar-gravitational environment is effectively simulated by an electronic system and is accurate during hover and translation maneuvers to within 0.02 earth g. The jet-engine attitude control systems have shown satisfactory response characteristics and excellent reliability. The lunar-simulation system has been effective in automatically controlling jet-engine thrust and attitude to provide a 1-lunar-g gravity vector acting on the vehicle and compensating for lift and drag aerodynamic disturbances. The pilots found the use of motion and visual cues to be valuable

in accomplishing translation maneuvers by vectoring the large jet-engine thrust in the gimbal-locked mode. For this reason, pilots indicated a preference for the gimbal-locked (VTOL) mode of operation over the local–vertical mode, which indicates that a more positive control of vehicle translation was possible with the gimbals locked. Author

N66-39898*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PEGASUS THERMAL DESIGN
Tommy C. Bannister and Robert J. Eby Washington, NASA, Nov. 1966 ref
(NASA-TN-D-3625) CFSTI: HC $2.00/MF $0.50 CSCL 22B

Analysis, design, testing, and flight data correlation are presented for the thermal control of Pegasus electronics. The temperature control was achieved by use of an active louver system similar to that used on the Mariner spacecraft. A seven-node mathematical thermal model of the electronics is described by seven simultaneous equations, and thermal vacuum orbital simulation tests are presented. A description of the thermal design of the Pegasus micrometeoroid detector panels is presented, as well as vacuum testing and flight data. S.P.

N66-39901*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPARISON OF RESULTS OF TWO SIMULATIONS EMPLOYING FULL-SIZE VISUAL CUES FOR PILOT-CONTROLLED GEMINI-AGENA DOCKING
Donald R. Riley, Byron M. Jaquet, Jack E. Pennington, and Roy F. Brissenden Washington, NASA, Nov. 1966 37 p refs
(NASA-TN-D-3687) CFSTI: HC $2.00/MF $0.50 CSCL 22A

An investigation involving seven astronauts as test subjects has been made to assess the overall compatibility of the results of two independent full-size simulations of pilot-controlled Gemini-Agena docking. One simulator (fixed base) employed a closed-circuit television system to display an image of the Agena target vehicle on a spherical screen. The other simulator (moving-base) used a dynamic full-size model of the Gemini spacecraft and a stationary three-dimensional target. A comparison of the results of the investigation in which only visual cues of the target vehicle were used for guidance information indicated that, after sufficient training, essentially the same results could be obtained from either simulator. Learning effects were found for both simulations; however, these effects were considerably more pronounced for the fixed- base simulator. Differences in the target markings and docking cones employed on the Agena models, a lack of three dimensions in the TV image, degradation of the visual cues due to the TV presentation, and the presence of the gravity-force angular cue in the moving-base simulator are partially responsible for this difference in learning effects. In addition to the simulator comparison, the docking results presented herein provide additional information on Gemini-Agena docking using the direct mode of control (on-off acceleration command system). Author

N66-39931*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PYROTECHNIC SHOCK ANALYSIS AND TESTING METHODS
Alan R. Hoffman and James E. Randolph 15 Feb. 1966 17 p
(Contract NAS7-100)
(NASA-CR-79187; JPL-TM-33-270) CFSTI: HC $1.00/MF $0.50 CSCL 22B

As the shock environment generated by explosive separation devices can have a deleterious effect on spacecraft operability, detailed analyses were made of certain pyrotechnic shocks. The measurements used were obtained from the ground testing of the Ranger and Mariner–Mars spacecraft using the actual explosive devices in their flight configuration. To determine the accuracy of the instrumentation, tests were conducted on the accelerometer limitations of the data analyzed. The shock spectra and statistical techniques used are discussed, and flight data, spacecraft test data, and assembly test data are compared. Results indicate: (1) The mechanical separation shock is generally the most severe pyrotechnic shock experienced by the spacecraft. (2) Flight telemetered data are inadequate for shock measurements due to lack of high frequency response and absence of spacecraft separation measurements. (3) Responses at the same location for different pyrotechnic devices tend to give the same spectra shape. (4) A system level pyrotechnic test program is necessary if the environment is to be properly simulated. M.G.J.

N66-39950*# National Aeronautics and Space Administration, Washington, D. C.
SECOND ORBITER LAUNCH SCHEDULED IN NOV. 6–11 PERIOD
30 Oct. 1966 61 p
(NASA-News Release-68-286) Available from the Scientific and Technical Information Division CSCL 22B

Descriptions are presented of the Lunar Orbiter B spacecraft; its camera, photo taking process, photo processing, photo readout, electric power, attitude and velocity control, communications, and the temperature control systems; its tasks of photography, landing site locations, selenodesy, and meteoroid and radiation measurements; the Atlas-Agena D launch vehicle and vehicle statistics; the Deep Space Network including data acquisition and evaluation; the Atlas-Agena/Lunar Orbiter mission and countdown events; and major flight events. R.N.A.

N66-39997*# Schjeldahl (G. T.) Co., Northfield, Minn.
DEVELOPMENT OF A 425 FOOT DIAMETER PASSIVE COMMUNICATION SATELLITE WITH SELF-ERECTING PROPERTIES Quarterly Progress Report No. 9
William Jacobi Aug. 1966 49 p *Its* Progr. Rept.-27M
(Contract NAS5-3943)
(NASA-CR-79091) CFSTI: HC $2.00/MF $0.50 CSCL 22B

A fabric was prepared from a Dacron-glass combination yarn and compared to a similarly woven sample of fiberglass. It was found that the fiberglass fabric had superior flexural rigidity and tensile strength. A number of sizing agents were evaluated; three commercial and ten laboratory sizes. Of the laboratory applied size Silane A1100 had the highest tensile strength and flexural rigidty. Of the four seam designs tested a simple overlap had the lowest resistance. Work on the determination of the fold resistance of the material is described. The effect of folding on electrical resistance is discussed. Several pilot production runs were made during this period, and data are presented describing the properties. Author

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N66-38806# Tokyo Univ. (Japan). Dept. of Aeronautics.
SELECTED PAPERS OF F. NAKANISHI
T. Okazaki, S. Kumagai, A. Watari, Y. Sato, K. Tsuda, ed., et al Jun. 1966 344 p refs CFSTI: HC $7.00/MF $1.75

Selected papers of Fujio Nakanishi on endurance limit of materials, plasticity of materials, and prime movers are presented. For individual titles see N66-38807–N66-38834.

N66-38807# Tokyo Univ. (Japan). Dept. of Aeronautics.
ENDURANCE LIMIT UNDER COMBINED ROTATING BENDING AND STATIC TENSION
Fujio Nakanishi *In its* Selected Papers of F. Nakanishi Jun. 1966 p 83–88 refs (See N66-38806 24-32) CFSTI: HC $7.00/MF $1.75

Endurance limits are discussed for uniform and nonuniform stress distrubition. Fatigue rupture is considered to take place in three stages: fatigue, failure or damage, and rupture. It is considered that there are two conditions of failure quite similar to those of static failure, and the endurace limit curve also consist of two branches. Expressions are developed for the endurance limits, and the similarity to the yielding of mild steel is pointed out. It is concluded that the calculated endurance limit curves under combined rotating bending and static tension accord closely with experiments. N.E.N.

N66-38808# Tokyo Univ. (Japan). Dept. of Aeronautics.
FATIGUE UNDER CYCLIC TORSION AND ROTATING BENDING
Fujio Nakanishi *In its* Selected Papers of F. Nakanishi Jun. 1966 p 88–94 refs (See N66-38806 24-32) CFSTI: HC $7.00/MF $1.75

Theoretical calculations and experimental results subjecting small bars of mild steel to cyclic torsion and rotating bending are compared. The relation between stress and fatigue is discussed. Equations are presented for the fatigue at a given distance from the center of the bar under cyclic shearing stress and cyclic bending stress. N.E.N.

N66-38809# Tokyo Univ. (Japan). Dept. of Aeronautics.
CRITERIA FOR ENDURANCE LIMITS OF STEEL
Fujio Nakanishi *In its* Selected Papers of F. Nakanishi Jun. 1966 p 94–108 refs (See N66-38806 24-32) CFSTI: HC $7.00/MF $1.75

Endurance limits under uniform and nonuniform stress are discussed. The conditions under tension-compression, rotating bending, cycle torsion, cyclic bending, and combinations of these are described. Theroetical expressions are given and comparison with experimental results for various steels is considered to be good. N.E.N.

N66-38810# Tokyo Univ. (Japan). Dept. of Aeronautics.
ENDURANCE LIMITS OF BEAMS OF VARIOUS CROSS-SECTIONS UNDER CYCLIC BENDING
Fujio Nakanishi *In its* Selected Papers of F. Nakanishi Jun. 1966 p 108–112 refs (See N66-38806 24-32) CFSTI: HC $7.00/MF $1.75

Fatigue and rupture of steel beams under cyclic bending are discussed. The results of experiments with carbon steel (0.57% C) of several cross sectional shapes are compared with theoretical calculations f of the endurance limits. Interference regions which are near zero, 1.0 mm, and 1.5 mm are considered. N.E.N.

N66-38811# Tokyo Univ. (Japan). Dept. of Aeronautics.
ANOTHER CRITERION FOR ENDURANCE LIMITS OF STEEL
Fujio Nakanishi *In its* Selected Papers of F. Nakanishi Jun. 1966 p 112–118 refs (See N66-38806 24-32) CFSTI: HC $7.00/MF $1.75

The deviation from theoretical endurance limits in special material under cyclic torsion was investigated. Nonuniform stress distribution, and combined static tension and cyclic torsion were considered. It was found that static stress has no effect on the endurance limit in the case of torsion, and that the limits of hollow cylinder are 8–10% smaller than those of solid ones. N.E.N.

N66-38812# Tokyo Univ. (Japan). Dept. of Aeronautics.
ENDURANCE LIMITS OF SOLID AND HOLLOW CYLINDERS UNDER TORSION
Fujio Nakanishi *In its* Selected Papers of F. Nakanishi Jun. 1966 p 119–125 refs (See N66-38806 24-32) CFSTI: HC $7.00/MF $1.75

The difference in endurance limits of solid and hollow soft steel cylinders under cyclic torsion is discussed. The factors to be considered in the case of soft steel are reviewed. Expressions are presented which predict the limits, and it is concluded that the phenomena are in agreement with theory. N.E.N.

N66-38813# Tokyo Univ. (Japan). Dept. of Aeronautics.
ON THE STRESS-STRAIN RELATION IN PLASTIC RANGE
Fujio Nakanishi *In its* Selected Papers of F. Nakaniski Jun. 1966 p 127–134 refs (See N66-38806 24-32) CFSTI: HC $7.00/MF $1.75

The relation between the twisting moment and the shear strain of the outermost layer in metal cylinders when the metal is twisted very slowly was investigated. The moment-strain curve was obtained by having a nonuniform strain speed but measuring points only under equilibrium. Details of the procedure are given, and the curves found are plotted. These curves have several sharp bends, and between the bends the curve is concave upwards. The stress–strain relation and the transition condition are discussed. It was concluded that: (1) There are several branches of stress–strain relation in plastic range, and each branch is concave upwards. (2) By increasing the strain, the state of material passes from one branch to the next. (3) The point of transition is different as to the stress distribution and is subject to the general law of transition. (4) The yield point of mild steel is not a special phenomenon. N.E.N.

N66-38814# Tokyo Univ. (Japan). Dept. of Aeronautics.
RELATION BETWEEN PURE SHEAR AND SIMPLE SHEAR IN PLASTIC RANGE, PART I
Fujio Nakanishi *In its* Selected Papers of F. Nakanishi Jun. 1966 p 134–140 ref (See N66-38806 24-32) CFSTI: HC $7.00/MF $1.75

Pure shear and simple shear in thin hollow cylinders are discussed from a theoretical viewpoint. The strain and stress relations, shear strain, and slip plane are studied. It was concluded that: (1) The slip plane in simple shear naturally coincides with the plane of the maximum shearing stress, and in pure shear it is a plane corresponding to that in simple shear. (2) The plane of the maximum shear strain and the slip plane coincide. (3) The shearing stresses on the slip planes of pure shear and simple shear are equal when the deformations are equal. (4) The deformations are the same provided the increase of shear strain is monotonic. N.E.N.

N66-38815# Tokyo Univ. (Japan). Dept. of Aeronautics.
RELATION BETWEEN PURE SHEAR AND SIMPLE SHEAR IN PLASTIC RANGE. PART II: EXPERIMENT
Fujio Nakanishi *In its* Selected Papers of F. Nakanishi Jun. 1966 p 140–145 (See N66-38806 24-32) CFSTI: HC $7.00/MF $1.75

Experiments are described to test the relation between pure shear and simple shear applied to thin tubes and solid cylinders when the material is considered to be isotropic in the virgin state. Details are given on the experiments when internal pressure only was applied to a tube, when internal pressure and tension were applied simultaneously to the tube, and when a twisting moment was applied to a solid cylinder. It was concluded that the results coincide well with the theory. N.E.N.

N66-38816# Tokyo Univ. (Japan). Dept. of Aeronautics.
THREE SHEAR THEORY OF PLASTICITY

Fujio Nakanishi *In its* Selected Papers of F. Nakanishi Jun. 1966 p 145–156 ref (See N66-38806 24-32) CFSTI: HC $7.00/MF $1.75

The theory of plasticity is based upon the following considerations: (1) Plastic deformation is divided into shears in three directions, and each is considered individually. (2) When the deformation increases monotonously, and when the directions of principal strains coincide with the principal stresses, the resistances to the shearing stresses. Hysteresis loops and anisotropy are mentioned, and pure shear and tension are emphasized. It was concluded that the theory accounts for the results from experiments. N.E.N.

N66-38817# Tokyo Univ. (Japan). Dept. of Aeronautics.
ANISOTROPY DUE TO PLASTIC DEFORMATION
Fujio Nakanishi *In its* Selected Papers of F. Nakanishi Jun. 1966 p 156–166 ref (See N66-38806 24-32) CFSTI: HC $7.00/MF $1.75

The three-dimensional theory of plasitcity is reviewed, and the anisotropy in a thin hollow cylinder due to plastic deformation is emphasized. Brass cylinders, with initial outer diameters being 18mm and the inner diameter 16mm, were subjected to preapplied loads of internal pressure pure shear, tension, and compression, and to reapplied to internal pressure. Stress–strain relations are discussed for various combinations of the loads and the reapplied internal pressure. It is concluded that anisotropy due to plastic deformation is explained by the theory. N.E.N.

N66-38818# Tokyo Univ. (Japan). Dept. of Aeronautics.
INTERNAL SHEARING RESISTANCES IN THE THREE SHEAR THEORY OF PLASTICITY
Fujio Nakanishi *In its* Selected Papers of F. Nakanishi Jun. 1966 p 166–171 refs (See N66-38806 24-32) CFSTI: HC $7.00/MF $1.75

The plasticity theory applied to plastic deformation and work hardening is described. The deformations due to slip in one, two, and three directions and the induced work hardening are described. It was concluded that the internal resistances in the three directions are equal in magnitude, and that it is a function of the amount of slips. N.E.N.

N66-38819# Tokyo Univ. (Japan). Dept. of Aeronautics.
INFLUENCE OF INTERMEDIATE PRINCIPAL STRESS ON PLASTIC FLOW
Fujio Nakanishi *In its* Selected Papers of F. Nakanishi Jun. 1966 p 171–181 refs (See N66-38806 24-32) CFSTI: HC $7.00/MF $1.75

Tests to determine the criterion of plastic flow in hollow brass cylinders in the range between tension and pure shear are reported. Tests were conducted to investigate the relations for various values of the ratio of principal stresses. In addition, the cylinders were deformed under tension, and then an internal pressure was applied step by step to examine whether there was an abrupt bend in the graphed relation of the ratio. Details of the experiment are given. The results showed clearly the bend predicted theoretically. N.E.N.

N66-38820# Tokyo Univ. (Japan). Dept. of Aeronautics.
STRAIN RATIO RELATIONSHIP IN PLASTIC DEFORMATION
Fujio Nakanishi *In its* Selected Papers of F. Nakanishi Jun. 1966 p 181–190 refs (See N66-38806 24-32) CFSTI: HC $7.00/MF $1.75

The strain ratio relationship is discussed on the basis of the three shear theory of plasticity. Details are given on the experiments in which hollow brass cylinders were subjected to combined tension and internal pressure of various ratios, the ratios being such that the values of the state of stress were always kept constant during the deformation. It was found that the material was not isotropic in the initial state, but became gradually isotropic as the plastic deformation proceeded. The strain ratio relationship is discussed for the case of pure shear, tension, and the intermediate state. According to the theory proposed, the state of stress cannot equal the strain ratio in plastic deformation, and this was borne out by experimental data. It is furhter concluded that an internal stress does exist. N.E.N.

N66-38821# Tokyo Univ. (Japan). Dept. of Aeronautics.
THE SHAPE OF MECHANICAL HYSTERESIS LOOP, ITS DEFORMATION DUE TO STRESS REPETITION AND RESULTING INCREASE IN FLOW STRESS. PART I: EXPERIMENT
Fujio Nakanishi *In its* Selected Papers of F. Nakanishi Jun. 1966 p 191–200 refs (See N66-38806 24-32) CFSTI: HC $7.00/MF $1.75

Experimental work on the hysteresis loop in elastoplastic stress–strain relation is reported. Solid brass cylinders were used for the tension test, and hollow cylinders for torsion and pure shear tests. The hysteresis loops were obtained by removing and reapplying loads between the maximum and zero shearing stresses after the specimen was deformed up to the plastic state. It was concluded that: (1) The stress–strain relation under unloading has the point symmetry to that under reloading. (2) The hysteresis loops have sharp bends. (3) The first portion of the loop is an elastic line whose slope is constant, while the slopes of the other portions vary during the repetition of the cyclic loading, with the last portion turning into a straight line. (4) After repetition, the stress of plastic flow rises slightly, and the curve shifts to the plastic curve of virgin specimen aftersome amounts of plastic deformation without developing any work hardening. N.E.N.

N66-38822# Tokyo Univ. (Japan). Dept. of Aeronautics.
THE SHAPE OF MECHANICAL HYSTERESIS LOOP, ITS DEFORMATION DUE TO STRESS REPETITION AND RESULTING INCREASE IN FLOW STRESS. PARTS II: THEORY FOR TORSION
Fujio Nakanishi *In its* Selected Papers of F. Nakanishi Jun. 1966 p 201–214 refs (See N66-38806 24-32) CFSTI: HC $7.00/MF $1.75

The behavior of the hysteresis loop in torsion is discussed, and is interpreted in accordance with the three shear theory of plasticity. The yield point is defined as the point where the stress–strain relation shifts from one curve to another, and the yield points in the hysteresis loops are described. Slip under plastic flow and slip under loading are mentioned. The shape of the hysteresis loop, the deformation of the loop due to repetition, and the rise of stress of plastic flow after repetition are discussed in detail. It was concluded that the behavior of the hysteresis loop under torsion can be accounted for by the proposed theory. N.E.N.

N66-38827# Tokyo Univ. (Japan). Dept. of Aeronautics.
ON THE FRICTION DAMPERS
Fujio Nakanishi *In its* Selected Papers of F. Nakanishi Jun. 1966 p 233–238 (See N66-38806 24-32) CFSTI: HC $7.00/MF $1.75

The characteristics of the Lanchester damper with dry friction were investigated for the cases with continuous relative slip, without relative slip, and with discontinuous slip. The exact resonance diagram was derived from solving the equations of motion, and the most favorable condition of tuning was determined. The damper with dry friction was compared with the Lanchester damper with viscous friction. It was concluded that the dry friction damper has the following disadvantages: (1) Resonance may occur at the resonance point of the main sys tem for some values of the

dry friction torque–exciting torque ratio. (2) The most favorable condition of tuning depends on the amplitude of the exciting torque. (3) The most favorable resonant amplitude is larger than that of the viscous friction damper, and is therefore less efficient. N.E.N.

N66-38846*# General Technology Corp., Torrance, Calif.
STRESS CONCENTRATION EFFECTS IN MICROPOLAR ELASTICITY Technical Report No. 8–4
P. N. Kaloni and T. Ariman Jun. 1966 24 p refs
(Contract NASw-1299)
(NASA-CR-78670) CFSTI: HC $1.00/MF $0.50 CSCL 20K

In the present note, consideration is given to the problem of stress concentration around a circular hole in the theory of micropolar elasticity. The results obtained appear to contradict the findings of Mindlin on the same problem based upon the linear theory of couple stress elasticity. Author

N66-38865*# Andrews Associates, Inc., Oklahoma City, Okla.
ACOUSTICAL AND VIBRATIONAL STUDIES RELATING TO AN OCCURRENCE OF SONIC BOOM INDUCED DAMAGE TO A WINDOW GLASS IN A STORE FRONT
Richard L. Lowery and Don K. Andrews [1966] 37 p refs
(Contract NAS1-5813)
(NASA-CR-66170) CFSTI: HC $2.00/MF $0.50 CSCL 20K

An analysis is presented of some acoustical and vibrational phenomena which may be involved in certain types of structures acted on by sonic boom shock waves. Mathematical models are formulated and applied to a specific incident of damage to a window glass in a store front which occurred during the series of sonic boom test flights at Oklahoma City in 1964. Some of the potential conditions for producing magnifications of response when certain tuning relationships exist between structural elements and/or between structural elements and the sonic boom shock wave elements are demonstrated. It was concluded that the assumed sonic boom shock wave would have been incapable of producing a critical stress level in this particular window installation. However, several significant facts were unknown and were not determinable such as the actual pressure-time history of the shock wave acting on the structure and window, and the condition of the window installation prior to breakage. Author

N66-38943*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
EFFECTS OF RECENT NASA ARC HYPERVELOCITY IMPACT RESULTS ON METEOROID FLUX AND PUNCTURE MODELS
Charles C. Dalton 7 Sep. 1966 47 p refs
(NASA-TM-X-53512) CFSTI: HC $2.00/MF $0.50 CSCL 20K

A formula for the just-puncturable thickness of a metallic target sheet is derived. The formula is used for an interpretative comparison of photographic meteor data and the puncture data from the three Pegasus and two Explorer meteoroid measurement satellites. The logarithm of the mass-cumulative influx of meteoroids per square meter per second is found to be a nonlinear function of the logarithm of the least-particle mass in grams. A cubic polynomial for this function, with −14.52, −1.406, −0.0490, and −0.00074 for the values of the coefficients of respective ascending powers, fits the data and seems most appropriate for extrapolation over the mass range for cometary particles. The influx of asteroidal particles is estimated separately. Author

N66-39069# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON STATIONARY PROPAGATION OF A SYSTEM OF CRACKS IN AN ELASTIC-BRITTLE MATERIAL
V. M. Kuznetsov *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 1–9 refs (See N66-39068 24-23) CFSTI: HC $7.00/MF $1.75

A mathematical formulation is given for the problem of an infinite elastic body in a plane state of stress in plane xy. It is assumed that there is an infinitely large number of cracks, parallel to the axis of the abscissas, and located at a distance 2h from each other in region $x \leq Vt$, where V=constant, and t=time. It is also assumed that there are no tangent stresses on the surface of the cracks. From the solutions obtained, the physical meaning of two conditions of crack development is defined as: (1) The rate of stationary spreading of a single crack increases with a decrease in pressure, i.e., a crack can continue to develop after the loads are removed. (2) In the case of a large number of cracks, such conditions are not always possible. With greater distance between cracks, every crack develops approximately as a single one. However, if the distance between cracks is small the spreading of each crack is substantially influenced by the other cracks. It was concluded that crack development is influenced by compressive forces acting from neighboring cracks. M.G.J.

N66-39070# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE DYNAMIC COMPRESSIBILITY OF HARD ROCKS AND METALS
S. A. Khristianovich and Ye. I. Shemyakin *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 10–23 refs (See N66-39068 24-23) CFSTI: HC $7.00/MF $1.75

A physical model of a solid medium is considered, in which significant internal friction is revealed during rapid loading. In the model studied, the solid is composed of closely packed balls, strongly cemented together. In rocks, the balls can be considered as separate crystals or blocks of rocks; in metals, as crystals or groups of neighboring crystals with specially strong bonds between them. Formulas are given to show the uniaxial compression of such a medium in a cylinder with rigid walls, with stress along the axis of the cylinder, and on the radius. The mechanism of internal friction is described by introducing the condition of plasticity. Equations are also formulated for dynamic loading. Attention is focused on the phenomena of damping of spherical waves in solids, and results of experiments in dynamic compression of iron and quartz in the plane wave shock are assessed. M.G.J.

N66-39071# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TOWARD A THEORY OF ANISOTROPIC CREEP
N. I. Malinin *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 24–40 refs (See N66-39068 24-23) CFSTI: HC $7.00/MF $1.75

The deficiencies which exist in various theories on anisotropic creep are assessed in relation to the need for determining the magnitude of creep for detecting stress distributions in a body. Possible variations of formulating anisotropic creep equations are also examined. It is pointed out that some variants constitute a generalization of equations of anisotropic plasticity; others, a generalization of isotropic creep dependences. In a limited check of theory, experiments were conducted on anisotropic creep during compression of glass fiber reinforced plastic (uniform strength) at 30°C. Analogous calculations were also carried out for the theories of aging and flow. Findings confirm that these theories satisfactorily describe the creep process only during smoothly-varying loads; during sharp changes in stresses, results significantly deviated from experiment. The need for creating a more universal creep theory for reinforced plastics is stressed, and the recommendation is made that consideration be given to features of structural anisotropy, and different nonlinear effects for describing material behavior during non-monotonically changing loads. M.G.J.

N66-39096# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TEMPERATURE STATE OF A SEMITRANSPARENT SPHERICAL SHELL
V.S. Zarubin *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 313–316 ref (See N66-39068 24-23) CFSTI: HC $7.00/MF $1.75

The problem is formulated for a thin spherical shell with a diathermal medium in its cavity. The shell is semitransparent and has optical characteristics which differ from a previous model in the shortwave (solar) and longwave (natural) radiation regions. The temperature over the thickness of the shell is considered to be invariable, and heat transmission by thermal conduction along the shell is disregarded. Author

N66-39097# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ONE PARAMETER OF HARDENING
N. S. Vilesona and V. S. Namestnikov *In its* J. Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 317–321 refs (See N66-39068 24-23) CFSTI: HC $7.00/MF $1.75

A hypothesis on the rate of creep and the hardening parameter is discussed, and details are given on an experiment conducted to compare this hypothesis with experimental data. Findings indicate that for nondescreasing loads, use of the hardening parameter results in better conformity with experiment than the usual hardening theory, without the need for introducing additional constants. For a diminishing load, conformity of the suggested theory with experiment showed some divergence. M.G.J.

N66-39098# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ROLLING A VISCO-ELASTIC CYLINDER ON A BASE OF THE SAME MATERIAL
R. Ya. Ivanova *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 322–330 refs (See N66-39068 24-23) CFSTI: HC $7.00/MF $1.75

A solution to the contact problem of linear viscoelasticity is presented based on the following assumptions: (1) Motion of the roller starts at moment of time $t=-\infty$, and continues with constant speed. (2) The problem is considered two-dimensional. (3) Roller and base material obeys the Boltzmann–Volterra law. (4) There is no volume after effect. For the considered medium in which the roller moves, the theory of elasticity is used to formulate the first basic problem; however, in the solution, elastic constants are replaced by operators to account for changed elastic properties of the material in time. M.G.J.

N66-39334# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NEWS OF THE ACADEMY OF SCIENCES OF THE USSR. MECHANICS AND MACHINE BUILDING Selected Articles
21 Feb. 1966 51 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekhan. i Mashinostr. (USSR), no. 4, 1964 p 63–76; 96–101; 172–177
(FTD-TT-65-1360; TT-66-61954; AD-636668) CFSTI: HC $3.00/MF $0.50

CONTENTS:

1. THE CREEP OF ANISOTROPIC BODIES L. M. Kachanov p 1–10 refs (See N66-39335 24-32)
2. VISCOUS-PLASTIC FLOW OF CIRCULAR DISKS AND CASES OF ROTATION G. I. Bykovtsev and T. D. Semykina p 11–28 refs (See N66-39336 24-12)
3. DEFORMATION BOUNDARY CONDITIONS IN THE THEORY OF ELASTICITY L. A. Rozin p 29–41 refs (See N66-39337 24-32)
4. ON THE SUPPORTING PROPERTIES OF A THIN LAYER OF GAS OR A CAVITATION LIQUID S. I. Sergeyev p 42–56 refs (See N66-39338 24-12)

N66-39335# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE CREEP OF ANISOTROPIC BODIES
L. M. Kachanov *In its* News of the Acad. of Sci. of the USSR. Mech. and Machine Building 21 Feb. 1966 p 1–10 refs (See N66-39334 24232) CFSTI: HC $3.00/MF $0.50

The creep of orthotropic metals is considered, including discussion of general theorems and some general methods of approximate solution. Equations of the steady creep of an orthotropic body are formulated, and variation equations are discussed. Equations of nonsteady creep are reviewed beginning with the simplest variant of the theory of flow. The effects of weak anisotropy are covered, and the steady creep of a long, thick pipe under the action of internal pressure was examined as an example. L.E.W.

N66-39337# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DEFORMATION BOUNDARY CONDITIONS IN THE THEORY OF ELASTICITY
L. A. Rozin *In its* News of the Acad. of Sci. of the USSR. Mech. and Machine Building 21 Feb. 1966 p 29–41 refs (See N66-39334 24-32) CFSTI: HC $3.00/MF $0.50

Deformation boundary conditions in the theory of elasticity are formulated, which permits a simplification of the form of boundary conditions, and which is particularly convenient for the solution of a different sort of contact problems in stress. The results for plane and space problems are given. It is possible to predict the form of deformation boundary conditions, starting from geometric considerations, if the results obtained in the envelope theory for a median surface are used. A full analysis of the discussed problem is introduced by means of transformation of the Lagrangian variation equation. Author

N66-39346# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELASTIC MECHANICAL PROPERTIES OF NONUNIFORM SANDWICH MEDIA
V. M. Gol'dfarb and A. V. Stepanov *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 163–174 refs (See N66-39346 24-23) CFSTI: HC $7.00/MF $1.50

Calculations are made of the relationships between properties of separate layers and properties of the medium as a whole in determining the behavior of nonuniform media under the action of external forces. Assumptions are that (1) the layers are isotropic; properties of the k-th layer are determined by values of elastic modulus, Poisson's ratio, and thickness, (2) the layers are rigidly joined, (3) the thickness of layers is small as compared to the transverse dimensions of the element, and (4) the state of stress within each layer is uniform. Areas given consideration include elastic constants of a sandwich medium, stresses in layers, anisotropic layers, and dependence of elastic constants on the geometry of layers. C.T.C.

N66-39357# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STABILITY OF EQUILIBRIUM OF PLATES ACCORDING TO THE THEORY OF PLASTIC FLOW
G. V. Ivanov *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 175–181 refs (See N66-39346 24-23) CFSTI: HC $7.00/MF $1.50

Consideration is given to the stability of a plate compressed in one direction for a case in which all edges are supported, and for a case when only two edges are supported. Critical stresses are determined under the limitation that during transition from the ground state to a neighboring state, perturbations causing unloading are not allowed. It is found that the stresses found

according to the theory of plastic flow are close to the values obtained with the theory of small elastic-plastic flows. C.T.C.

N66-39358# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CREEP RUPTURE
Yu. N. Rabotnov *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 182–200 refs (See N66-39346 24-23) CFSTI: HC $7.00/MF $1.50

Considertion is given to theories of creep which describe the creep curve just prior to destruction. The theories are formulated such that the rate of creep is a function of stress, temperature, and a set of parameters determining the state of the material. These parameters in turn are connected by differential relationships. Areas covered include viscous rupture, brittle rupture, mixed rupture, brief creep, complex states of stress, and extension and torsion of thin pipes. C.T.C.

N66-39359# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CREEP BUCKLING WITH CALCULATION OF INSTANTANEOUS PLASTIC FLOWS
S. A. Shesterikov *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 201–211 refs (See N66-39346 24-23) CFSTI: HC $7.00/MF $1.50

Two examples are investigated in order to elucidate certain peculiarities in determinations of creep buckling by the theory of instantaneous plastic flows. A idealized I-beam is assumed in which the state of stress is completely determined by deflection and the longitudinal force. This is designated as a one-parameter system, and one of the examples is investigated under these assumptions. The other example considers a simple case of a system with more than one parameter in which the beam consists of three separate webs. C.T.C.

N66-39360# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
USE OF THE KERR EFFECT FOR STUDYING THE STATE OF STRESS OF THIN- WALLED CONSTRUCTION
V. M. Nikitin *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 212–216 refs (See N66-39346 24-23) CFSTI: HC $7.00/MF $1.50

An optical method based on the phenomenon of artificial double refraction in liquids placed in an electric field (Kerr effect) is presented. This method determine the displacement of external or inner surfaces with the aid of interpolation formulas or the finite difference method. It is concluded that studies of the state of stress in plates and shells are greatly simplified by this method. C.T.C.

N66-39362# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MEASUREMENT OF STRESS WAVES IN SOFT GROUNDS
V. D. Alekseyenko, S. S. Grigoryan, L. I. Koshelev, A. F. Novgorodov, and G. V. Rykov *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 223–239 refs (See N66-39346 24-23) CFSTI: HC $7.00/MF $1.50

Results are discussed from experiments on the propagation of blast waves in sandy grounds. A mathematical model of the soft medium is offered, and a tensometric transducer for stress wave measurement is described. Stress field measurements are used to construct functions of the medium plastic properties, and it is stated that formulations indicate the existence of a universal function of plasticity. A.G.O.

N66-39364# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BASIC EQUATIONS OF SOIL DYNAMICS
N. A. Alekseyev, Kh. A. Rakhmatulin, and A. Ya. Sagomonyan *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 249–258 refs (See N66-39346 24-23) CFSTI: HC $7.00/MF $1.50

Consideration is given to fundamental equations of motion which show that soils are a plastic body with nonlinear and irreversible volumetric strain properties. The soil is simulated by a solid, compressible medium, allowing finite plastic flows. Prandtl plasticity criteria are applied in studies of one-dimensional soil motion, and motion equations are derived on the basis of the theory of finite elasto-plastic flows. A.G.O.

N66-39375# Southwest Research Inst., San Antonio, Tex.
THE EFFECT OF OUT-OF-ROUNDNESS ON THE STRESS DISTRIBUTION IN PRESSURE VESSELS
[1966] 128 p refs Transl. into ENGLISH from German

CONTENTS:

1. CALCULATION OF STRESS FOR AN OUT-OF-ROUND TUBE UNDER INTERNAL PRESSURE K. Schmidt p 1–17 refs (See N66-39376 24-32)

2. A SIMPLE STRESS CALCULATION FOR AN OUT-OF-ROUND TUBE UNDER INTERNAL PRESSURE H. Wagner p 19–26 refs (See N66-39377 24-32)

3. STRESS CALCULATION FOR AN OUT-OF-ROUND TUBE UNDER EXTERNAL PRESSURE. PART I: THE CYLINDRICAL TUBE WITH AN OUTWARD BUCKLE K. Schmidt p 27–71 refs (See N66-39378 24-32)

4. THE EFFECT OF OUT-OF-ROUNDNESS IN A PRESSURE VESSEL ON STRESSES AND CHANGES OF SHAPE, WITH SPECIAL REFERENCE TO A CELLULOSE DIGESTER J. Kilpi p 73–107 refs (See N66-39379 24-32)

5. STRESS IN AN OUT-OF-ROUND PRESSURE VESSEL K. Schmidt p 109–120 refs (See N66-39380 24-32)

N66-39376# Southwest Research Inst., San Antonio, Tex.
CALCULATION OF STRESS FOR AN OUT-OF-ROUND TUBE UNDER INTERNAL PRESSURE
Kurt Schmidt *In its* The Effect of Out-of-Roundness on the Stress Distribution in Pressure Vessels [1966] p 1–17 refs Transl. into ENGLISH from VDI (Ver. Deut. Ingr.) Z. (Dusselkorf), v. 98, no. 4, Feb. 1956 p 121–125 (See N66-39375 24-32)

Formulas are developed for the bending stresses due to out-of-roundness in tubes, drums, and similar cylindrical vessels under internal pressure, which unintentionally deviate from a circular shape. Three cases are considered: (1) stress resulting from a angular buckle, (2) stress in a tube of oval cross section, and (3) stress in a tube with a shallow inward buckle. Results of case comparisons show that there are differences with regard to bending stresses, and itis concluded that rules being used for determining the permissible out-of-roundness do not state the actual stresses. A.G.O.

N66-39377# Southwest Research Inst., San Antonio, Tex.
A SIMPLE STRESS CALCULATION FOR AN OUT-OF-ROUND TUBE UNDER INTERNAL PRESSURE
H. Wagner *In its* The Effect of Out-of-Roundness on the Stress Distribution in Pressure Vessels [1966] p 19–26 refs Transl. into ENGLISH from VDI (Ver. Deut. Ingr.) Z. (Dusseldorf), v. 98, no. 20, Jul. 1965 (See N66-39375 24-32)

An approximate formula is derived for the stress in an out-of-round tube under internal pressure. The stress calculation is demonstrated in a problem which consists of finding, for a thin walled tube under internal pressure, that part of the tangential stress due to out-of-roundness which is superposed on the normal stress. It is noted that these additional bending stresses multiply the normal stresses and are essential for a stress calculation. A.G.O.

N66-39378# Southwest Research Inst., San Antonio, Tex.
STRESS CALCULATION FOR AN OUT-OF-ROUND TUBE UNDER EXTERNAL PRESSURE. PART I: THE CYLINDRICAL TUBE WITH AN OUTWARD BUCKLE. PART II: THE ORIGINALLY ELLIPTICAL TUBE
Kurt Schmidt *In its* The Effect of Out-of-Roundness of the Stress Distribution in Pressure Vessels [1966] p 27–71 refs Transl. into ENGLISH from VDI (Ver. Deut. Ingr.) Z. (Dusseldorf) v. 101, no. 2, 1959; v. 101, no. 4, 1959 (See N66-39375 24-32)

In contrast to the out-of-round tube under internal pressure and to similar cylindrical hollow bodies, for which calculations of the response can be made from measurements of the initial state, the tube under external pressure requires a special treatment, for the stress state depends essentially on the ensuing changes in shape. For the case of the originally cylindrical tube under external pressure which buckles under loads in excess of the critical and takes an out-of-round shape, an accurate solution is obtained in the elastic range by means of the changes in shape and the state of stress. An approximate solution is developed for a tube of originally elliptical cross section. Author

N66-39379# Southwest Research Inst., San Antonio, Tex.
THE EFFECT OF OUT-OF-ROUNDNESS IN A PRESSURE VESSEL ON STRESSES AND CHANGES OF SHAPE, WITH SPECIAL REFERENCE TO A CELLULOSE DIGESTER
J. Kilpi *In its* The Effect of Out-of-Roundness on the Stress Distribution in Pressure Vessels [1966] p 73–107 refs Transl. into ENGLISH from VDI (Ver. Deut. Ingr.) Z. (Dusseldorf), v. 101, no. 11, 1959, v. 101, no. 14, 1959 (See N66-39375 24-32)

Preliminary assumptions for stress calculations are related, and the stress formulas of P. Laasonen and K. Schmidt are analyzed. A ring with a shallow inward buckle was used to test the stress formulas and was stressed with a mechanical load which simulated internal pressure. It is reported that the measured stresses and shape changes agreed well with those predicted by the formula of P. Laasonen and less well with those from the formula of K. Schmidt. Changes in regard to tolerances are proposed which are based on the application of the measurement results to lined or plated digesters, as well as consideration of shape tolerance for digesters, and procedures for testing of tolerances. A.G.O.

N66-39380# Southwest Research Inst., San Antonio, Tex.
STRESS IN AN OUT-OF-ROUND PRESSURE VESSEL
Kurt Schmidt *In its* The Effect of Out-of-Roundness on the Stress Distribution in Pressure Vessels [1966] p 109–120 refs Transl. into ENGLISH from VDI (Ver. Deut. Ingr.) Z. (Dusseldorf), v. 102, no. 1, 1960 (See N66-39375 24-32)

Consideration is given to the differences in results of stress and strain measurements on an out-of-round cylindrical celluose digester under internal pressure obtained from formulas of B.P. Haigh and K. Schmidt. The connection between the two theoretical results is demonstrated and the cause of the resulting deviations is explained. Stress calculations are analyzed for bending in the undeformed state, bending in the deformed state under internal and external pressure, and change of shape of the deformed state. A.G.O.

N66-39444# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.
EXPERIMENTAL STUDY OF THE RANDOM VIBRATIONS OF AN AIRCRAFT STRUCTURE EXCITED BY JET NOISE
B. L. Clarkson and R. D. Ford Jan. 1960 32 p refs
(Contract AF 61(052)-332)
(AASU-128; AD-638142) CFSTI: HC $3.60/MF $0.50

Recordings have been made of the strains induced in a full scale rear fuselage test structure of the Caravelle air-liner when one jet engine is running at maximum takeoff thrust. The analysis has been concentrated on the strains in the centres of panels. Correlation measurements indicate that the larger panel strains occur above 500 c.p.s. with the frames acting as boundaries. The main resonance peak in each panel has been identified with the fundamental stringer-twisting mode but the mode-shapes for the two smaller peaks have not been completely determined. An attempt has been made to calculate the panel resonant frequencies theoretically. Author

N66-39445# New Mexico Univ., Alburquerque. Bureau of Engineering Research.
AN EXPERIMENTAL STUDY OF FRACTURE UNDER REVERSED SHEAR
F. D. Ju, J. G. Baker, and J. T. P. Yao May 1966 80 p refs
(Grant AF-AFOSR-568-66)
(ME-21; AFOSR-SR-66-0889; AD-486843)

A low-cycle shear model was established, and shear deformation up to fracture was measured under reversed loads. The basic configuration was a tensile-loaded double shear sheet state at large deformation and to permit reversal of this deformation. The basic configuration was a tensile-loaded "double shear" sheet specimen which had doubly symmetric cut-outs to allow complete reversals of the shear. The moiré fringe method, bire-fringent technique, and grids of printed dots were used to determine the deformation in the critical section. Quantitative shear deformations were obtained by measuring the angle of rotation of printed grid lines. A uniform shear state was found in a narrow band across the critical section excluding the immediate neighborhoods at the tips of the cut-outs. Fracture resulting from one-cycle of reversed shear was obtained together with quantitative measurement of localized shear deformation at the critical section. The configuration seems to meet the requirements for a low-cycle shear fracture model and is applicable for finding a criterion for low-cycle shear fracture. Author

N66-39462# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROBLEMS IN DYNAMICS AND STABILITY OF SHELLS
P. M. Ogibalov 22 Mar. 1966 443 p refs Transl. into ENGLISH of the book "Voprosy Dinamiki i Ustoychivosti Obolochek" Moscow, Izd. Mosk. Univ., 1963 417 p
(FTD-MT-64-351; TT-66-62058; AD-637155) CFSTI: HC $7.43/MF $2.00

The book examines problems of oscillations of shells: their natural and parametric oscillations, panel flutter, and certain other dynamics problems. Also examined are problems of stability of shells within and beyond the limits of elasticity of their material and certain special problems of calculation of shells, among them the effects of hardening of shells through cold-hardening, heterogeneity of the material, and penetrating irradiation. TAB

N66-39464# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PLATES AND SHELLS IN TURBINE ROTORS
A. D. Kovalenko 17 Mar. 1966 412 p refs Transl. into ENGLISH of the Book "Plastiny i Obolochki v Rotorakh Turbomashin" Kiev, Izd. Akad. Nauk Ukr., SSR 1955 303 p
(FTD-TT-65-1258; TT-66-62131; AD-637592) CFSTI: HC $7.10/MF $2.00

This book is devoted to an investigation of the stressed and deformed states of thin round plates and shells of revolution, used as thin-walled elements in turbine rotors. A characteristic feature of the book is the investigation of the exact solutions for the indicated problems by means of the theory of special functions and the modification of the solutions to a form convenient for practical application. The book contains numerous tables of functions, solutions and theoretical coefficients required for design of disks, round plates and shells of revolution. The book is intended for scientific researchers and designers engaged in the field of turbine construction Author (TAB)

N66-39475# Lockheed-Georgia Co., Marietta.
SONIC FATIGUE IN COMBINED ENVIRONMENT Technical Report, Apr. 1964–Dec. 1965
John R. Ballentine, Harry E. Plumblee, and Cecil W. Schneider Wright-Patterson AFB, Ohio. AF Flight Dyn. Lab., May 1966 164 p refs
(Contract AF 33(615)-1481)
(ER-8452; AFFDL-TR-66-7; AD-637506) CFSTI: HC $5.00/MF $1.00

Research on sonic fatigue in combined environment is described. Emphasis is placed on determining the effects of structural curvature, low-frequency vibratory loads, and heat, both singly and collectively, on sonic fatigue. The analytical and experimental investigation is presented in two major phases: (1) An investigation of simple structural panels to determine the effect of curvature and heat cycling schemes on dynamic response and fatigue. (2) An investigation to determine the effects of high-intensity sound, heat, and low-frequency vibratory loads on curved titanium-faced honeycomb sandwich panels. Author (TAB)

N66-39499# Marine Engineering Lab., Annapolis, Md.
A MATHEMATICAL MODEL DEFINING THE ACOUSTIC RADIATION FIELD GENERATED BY SPACIALLY DISTRIBUTED FORCE INPUTS TO THE HULL OF A SHIP
Richard P. Bailey Aug. 1966 139 p refs
(Contract N161-25928)
(MEL-14/66; AD-637470) CFSTI: HC $4.00/MF $1.00

To find simplified expressions for the radiation patterns of complex submerged vibrating bodies, such as submarines, a mathematical model was constituted. It defines the acoustic radiation field generated by the energy sources, an array of point sources on an infinitely long cylindrical baffle replaces the internal energy sources. Sufficiently-simple approximate expressions for radiated energy are obtained so that theory and experiments can be compared numerically in a fairly uncomplicated fashion, since the required pattern computations are easily programmed. If these results are not satisfactory then the only other road open appears to be to treat the finite cylinder and eventually the elastic case. Author (TAB)

N66-39521# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ABOUT HYSTERESIS ENERGY AS THE MAIN CRITERION OF DESTROYING METAL AT CYCLIC MONOAXIAL STRESS
G. S. Pisarenko and M. S. Mozharovs'kiy 23 Feb. 1966 7 p refs Transl. into ENGLISH from Dopovidi Akad. Nauk Ukr. RSR (Kiev), no. 7, 1964 p 893–898
(FTD-TT-65-1433; TT-66-62112; AD-637439) CFSTI: HC $1.00/MF $0.50

The basic regularities of thermal fatigue are discussed in this article. It can be asserted that the basic criterion of metal failure with cyclic thermal loading should be considered as the value of the specific irreversible absorbed energy, which simultaneously takes into account both the stresses and strains. Author (TAB)

N66-39545*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
BENDING STRENGTH OF A LARGE THIN-WALLED PRESSURE-STABILIZED CYLINDER BEYOND ONSET OF COMPRESSIVE SKIN WRINKLING
Robert P. Miller and Theodore Gerus Washington, NASA, Nov. 1966 23 p refs Presented at the SAE Aero and Space Eng. and Manufacturing Meeting, Los Angeles, 3–7 Oct. 1966 Supersedes NASA-TM-X-52229; see X66-37371 34-32
(NASA-TM-X-1311; NASA-TM-X-52229) CFSTI: HC $1.00/MF $0.50 CSCL 20K

The test article consisted of a 120-inch-diameter Atlas stub D booster tank, which was constructed of 301 extra full-hard stainless steel varying in thickness from 0.014 to 0.023 inch in the wrinkle area. For testing the vessel was filled with water and pressurized to 24 pounds per square inch gage. The results of this test indicate that within the test environment the ultimate bending moment capability of a thin-walled pressure-stabilized cylinder with typical axial loads is at least 50 percent greater than the bending moment at which compressive wrinkling first occurs. The wrinkles formed by the bending load appeared as relatively shallow, circumferential waves progressing from initial irregularities at the tank lap joints. The wrinkles appeared to be elastic in nature with no permanent set. This investigation further indicates that the bending moment capability of a thin-walled pressurized cylinder beyond the point of wrinkling onset can be described with reasonable accuracy by a relatively simple analysis as outlined in this report. Author

N66-39556# California Inst. of Tech., Pasadena. Graduate Aeronautical Labs.
ON COMPARING THEORY AND EXPERIMENT FOR THE SUPERSONIC FLUTTER OF CIRCULAR CYLINDRICAL SHELLS
Mervyn D. Olson Jun. 1966 115 p refs
(Grant AF-AFOSR-352-63)
(AFOSR-66-0944; AD-637234) CFSTI: HC $4.00/MF $0.75

The flutter boundaries obtained from recent experiments on the supersonic flutter of circular cylindrical shells are compared with various theoretical predictions. Following Voss, a model analysis is used in conjunction with different aerodynamic approximations - namely, piston theory and the potential solution of Leonard and Hedgepeth. It was found that the pressurized cylindrical shells fluttered at a lower level of free stream energy than predicted by the theory. Of the two results, that using piston theory appears to correspond closest to the experiment. The influence of the viscous boundary layer on cylindrical shell flutter is reexamined. The boundary layer is modeled by a parallel shear flow, and the oscillating shell surface is approximated by an oscillating plane wall whose deflection is sinusoidal in both in-plane directions. Viscous effects are neglected with respect to flow perturbation quantities, nonlinear terms are neglected, and the final equations are integrated numerically through the boundary layer. It was found that, for the thicknesses of boundary layer present in the experiments, the resulting pressures on the oscillating wall are reasonably close to the corresponding potential theory ones. Hence, in that sense, the influence of the boundary layer appears to be negligible for shell flutter with many circumferential waves. Author (TAB)

N66-39586# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THERMAL FATIGUE OF HEAT-RESISTANT MATERIALS UNDER CONDITIONS OF UNIAXIAL STRESSED STATE
L. P. Nikitina 21 Feb. 1966 14 p Transl. into ENGLISH from the Publ. "Voprosy Mekhanicheskoi Ustalosti" Moscow, Izd. Mashinostr., 1964 p 226–233
(FTD-TT-65-1364; TT-66-62113; AD-637440) CFSTI: HC $1.00/MF $0.50

Simplified tests were conducted on thin walled tubular specimens under conditions of thermal cycling with uniaxial tension or compression to determine the nature of material fatigue from repeated thermal stresses. The results are tabulated and discussed. R.N.A.

N66-39609*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SUBSONIC AND SUPERSONIC FLUTTER ANALYSIS OF A HIGHLY TAPERED SWEPT-WING PLANFORM, INCLUDING EFFECTS OF DENSITY VARIATION AND FINITE WING THICKNESS, AND COMPARISON WITH EXPERIMENTS
E. Carson Yates, Jr. Washington, NASA, Mar. 1963 76 p refs
(NASA-TM-X-764) CFSTI: HC $2.50/MF $0.75 CSCL 20K
(Declassified)

Flutter characteristics of several wings with an aspect ratio of 4.0, a taper ratio of 0.2, and a quarter-chord sweepback of 45° have been investigated analytically for Mach numbers up to 2.0. The calculations employed the modified-strip-analysis method, the subsonic-kernel-function method, spin theory, and quasi-steady second-order theory. Author

N66-39619*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INVESTIGATION OF FLUTTER CHARACTERISTICS OF THREE LOW-ASPECT-RATING ALL-MOVABLE HALF-SPAN CONTROL SURFACES AT MACH NUMBERS FROM 1.49 TO 2.87
Homer G. Morgan, Irving E. Figge, and John G. Presnell, Jr. Washington, NASA, 2 May 1958 40 p refs
(NACA-RM-L58B20) CFSTI: HC $2.00/MF $0.50 CSCL 20K
(Declassified)

Results of aflutter investigation made in the Langley Unitary Plan wind tunnel are reported for various ratios of uncoupled bending frequency to uncoupled pitching frequency. Some results were also obtained with a mass balance distributed along the leading edge of the wing. Results of calculations using piston theory are presented and compared with experiment. Frequency ratios near 1 were found to give the lowest flutter speeds. Author

N66-39637# Army Materials Research Agency, Watertown, Mass. Materials Engineering Div.
ANALYSIS OF EDGE NOTCHES IN A SEMI-INFINITE REGION
Oscar L. Bowie Jun. 1966 20 p refs
(AMRA-TR-66-07; AD-637695) CFSTI: HC $1.00/MF $0.50

A procedure for solving the plane elastic problem for edge notches in a semi-infinite region is presented. A modification of the conventional Muskhelishvili technique is made by utilizing a mapping function which describes both the physical region and its reflection with respect to the straight edges. An effective power series development in the parameter plane is then described and illustrated by the numerical solution for semi-elliptical notches in a semi-infinite sheet in tension at infinity parallel to the edge. Author (TAB)

N66-39649# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
VARIOUS METHODS OF ANALYSIS OF SANDWICH PLATES WITH BENDING AND THEIR COMPARISON BY EXPERIMENT
A. A. Nikishin 22 Apr. 1966 20 p refs Transl. into ENGLISH from Inzh.-Stroit. Inst. Sterzhni i Plastinki (USSR), issue 44, 1963 p 103-118
(FTD-MT-65-288; TT-66-62103; AD-637430) CFSTI: HC $1.00/MF $0.50

The basic calculated values of a sandwich panel and the character of state of strain in the filler depend on the two basic parameters theta sub 1 and theta sub 2. (1) Under the condition that theta sub 2 >> nu sub 2 is clearly fulfilled when theta sub 2 > or = 3500, bucklings calculated by the different methods are scarcely distinguished among themselves, irrespective of support conditions. With a smaller value of theta sub 2 and various conditions of external layer support, bucklings are described best of all by the solution based on the assumption E sub xx = 0 (second method). (2) It is possible to determine the approximate values of direct stresses in the sheathing, with elastic deformations in a wide range of basic parameter values, by the standard beam formulas of strength of materials for a hollow beam. (3) The distribution of direct sigma sub 2 and tangential stresses along the height of the filler, both by exact solution and experimentally, confirms the applicability of the second method based on the assumption E sub xx = 0. The theoretical distribution of sigma sub 2 along the length of the filler, calculated by the shown method, and also the magnitude of its maximum value satisfactorily coincide with the experiment. This means that the state of strain in the filler best of all describes the solution obtained by the second method. (4) For clarifying the supporting power of a sandwich plate under prolonged loading, it is necessary to consider highly elastic deformation in the sheathing Author (TAB)

N66-39657# Royal Aircraft Establishment, Farnborough (England).
THERMAL CONDUCTANCE OF LAP-JOINTS IN VACUUM
A. B. Osborn and W. N. Mair
(RAE-TR-66034; AD-637770) CFSTI: HC $2.00/MF $0.50

Experiments on the thermal conductance, in vacuum, of lap-jointed specimens of aluminium-clad L72, and unclad L70, aluminium alloys (4% Cu; 0.7% Si; 0.7% Mn) are described. The specimens were strips of thin sheet fastened with rivets, or nuts and bolts. The effects of variability of riveting technique, temperature, thermal cycling, overlap area, bolting-torque, burrs, and interlayers of paint, anti-corrosive jointing compound, indium and electrical insulators were studied. In general, the results support a mechanism of high heat transfer, by metallic conduction, near the rivets or bolts only. This hypothesis is discussed, and it is suggested that the thermal behaviour of the specimens is described better in terms of an additional length of heat-conduction path than by a conventional heat transfer coefficient. It was found, if burrs are removed, that both careful bolt-tightening and standard, aircraft-construction, riveting techniques produce thermally good lap-joints for which the effect of the doubled thickness is equal to, or greater than, the opposing effect of the interfacial thermal resistance Author (TAB)

N66-39660# Brown Univ., Providence, R. I.
THERMODYNAMICS AND WAVE PROPAGATION IN NON-LINEAR MATERIALS WITH MEMORY
Bernard D. Coleman and Morton E. Gurtin Apr. 1966 49 p refs
(Contract Nonr-562(40))
(TR-14; AD-637609) CFSTI: HC $2.00/MF $0.50

One-dimensional waves in materials which do not conduct heat but have long-range nonlinear viscoelastic memory are discussed. The theory starts with the constitutive assumption that the stress, temperature, and specific internal energy at a material point depend on the temporal histories of the strain and specific entropy at the point. The functionals expressing this dependence are not assumed to have any special properties other than those implied by Coleman and Nolls form of the principle of fading memory and the laws of thermodynamics. Particular emphasis is laid on a theorem in the thermodynamics of materials with memory relating the stress and temperature functionals to the internal-energy functional. Much of the classical theory of Hugoniot curves can be generalized to materials with memory. The conclusion that for weak shocks the jump in the entropy must be of order three or higher in the jump in the strain and the theorems of Bethe and Weyl for shocks of finite strength still hold in the present theory. Duhems theory of homentropic waves is generalized, explicit and exact expressions for the wave amplitude are calculated. (Author) TAB

N66-39711*# Brown Engineering Co., Inc., Huntsville, Ala. Research Labs.
A SURVEY OF RING BAFFLE DAMPING IN CYLINDRICAL TANKS
G. P. Stricklin and J. A. Baird Apr. 1966 35 p
(Contract NAS8-20073)
(NASA-CR-78985; R-185) CFSTI: HC $2.00/MF $0.50 CSCL 20K

A survey of Miles' method for determining the damping procced by ring baffles in cylindrical tanks was conducted. O'Neill's

modification of Miles' equation which eliminates free surface wave height from this equation is discussed. Experimental investigations from several sources which determine the damping and frequency of liquid oscillation in ring baffled cylindrical tanks are surveyed. These experimental investigations give an indication of the conditions for which Miles' equation is applicable. Author

N66-39806# Lockheed Missiles and Space Co., Palo Alto, Calif.
STABILITY OF A COMPRESSED PLATE LOADED ON THE FREE EDGE
R. A. Rimskii [1966] 5 p ref Transl. into ENGLISH from Vopr. Prikl. Mekh. (Moscow), Issue 225 1966 p 56-62 CFSTI: HC $1.00/MF $0.50

Equations are presented for a constant-thickness plate for which part of the contour subjected to longitudinal loading is free. Preliminary refinement of the boundary conditions on the free part of the contour is required for solving the problem. Equations are presented for the total energy of a plate subjected to loading. The desired critical loadings are obtained by equating the determinant of the boundary conditions to zero. S.P

N66-39810# Lockheed Missiles and Space Co., Palo Alto, Calif.
ANALYSIS OF THE DEFORMATION OF THIN-WALLED TUBES
L. V. Bubnova [1966] 4 p refs Transl. into ENGLISH from Izv. Vysshikh. Uchebn., Mashinostr. (Moscow), no. 11, 1965 p 135-142 CFSTI: HC $1.00/MF $0.50

The stress and strain states in drawing, broaching, reducing, and expanding thin-walled tubes in rigid conical matrices are investigated on the basis of the membrane theory of the axisymmetrically loaded shells of revolution. An arbitrary tension diagram of a rigidly-hardened body underlies study. In solving the problem the Huber-Mises plasticity condition is utilized. Numerical methods and the Huber-Mises criterion are used to solve the problem of strengthening the material. The other of computation is explained for each of the four cases. S.P

N66-39811# Lockheed Missiles and Space Co., Palo Alto, Calif.
RITZ METHOD IN NONCONSERVATIVE PROBLEMS OF ELASTIC STABILITY THEORY
G. A. Marchenko [1966] 6 p refs Transl. into ENGLISH from Izv. Vyssh. Uchebn. Zaved., Aviats. Tekh. (Kazan), no. 3, 1966 p 62-68 CFSTI: HC $1.00/MF $0.50

The stability of elastic systems subjected to nonconservative loadings is considered using the Ritz method in a nonvariational treatment. The expression for the virtual work of an elastic system subjected to nonconservative forces is given, and the classical example of a cantilever rod with a following force at the free end is considered. In applying the Ritz method, only the computational procedure is retained. Equations are presented for a rectangular cantilever plate in a stream perpendicular to the fixed side and parallel to the fixed side. It is concluded that the Ritz method can successfully be used to analyze a specific object with variable stiffness and complex boundary conditions. S.P

N66-39813# Aeronautical Research Labs., Melbourne (Australia)
BUCKLING OF CYLINDRICAL SHELLS UNDER WIND LOADING
B. P. Holownia Aug 1964 25 p refs
(ARL/SM-292) CFSTI: HC $1.00/MF $0.50

An investigation of buckling of thin circular cylinders subjected to wind loading is presented. A theoretical analysis of the problem was attempted but because of the formidable computations that were involved this was replaced by an experimental investigation utilising a wind tunnel. An empirical formula for the buckling pressure was derived which gives reasonable agreement with the experimental results, and it may easily be used by designers. Author

N66-39881# Lockheed Missiles and Space Co., Palo Alto, Calif.
Teorii Obolochek i Plastinki (Erevan), v. 4, 1964 p 997-1007
DYNAMICS OF AN ELASTIC AND VISCOELASTIC SHELL FILLED WITH AN IDEAL FLUID
Iu. S. Shkenev [1966] 10 p refs Transl. into ENGLISH from Teorii Obolochek i Plastinki (EREVAN), v. 4, 1964 p 997-1007 CFSTI: HC $1.00/MF $0.50

The vibrations of an elastic and viscoelastic cylindrical shell partially filled with a weighable ideal fluid were considered. Hypotheses of nonlinear shell theory were used in solving the nonlinear problem of the vibrations of a shell with a fluid. The frequencies of the low coupled vibrations of the shell and the fluid, the frequencies of the nonlinear vibrations, and the critical frequencies of the perturbing loadings were determined. Author

N66-39896*# California Univ., Berkeley.
EQUATIONS FOR THERMOELASTIC AND VISCOELASTIC CYLINDRICAL SANDWICH SHELLS
Wolfgang J. Oberndorfer Washington, NASA, Nov. 1966 74 p refs
(Grant NsG-637)
(NASA-CR-645) CFSTI: HC $2.50/MF $0.75 CSCL 20K

Equations governing small deformation of a cylindrical sandwich shell are derived from the principle of minimum potential energy. The facings are thin orthotropic shells with different physical properties and thicknesses, and a weak orthotropic core is considered. The effect of an arbitrary temperature distribution is included. Two examples are presented: (1) uniform heating of a finite segment of a shell of infinite extent (elastic core) and (2) uniform heating of a shell of infinite extent (elastic core) and (2) supporting a ring load. Author

N66-39903*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
BENDING TESTS OF TWO LARGE-DIAMETER CORRUGATED CYLINDERS WITH ECCENTRIC RING STIFFENERS
James Kent Anderson Washington, NASA, Nov. 1966 25 p refs
(NASA-TN-D-3702) CFSTI: HC $1.00/MF $0.50 CSCL 20K

Results of bending tests on two large-diameter aluminum-alloy corrugated cylinders with eccentric (one-sided) stiffening rings are presented. The cylinders were identical except for the location of stiffening rings; one cylinder had rings attached to the external surface of the cylinder, the other had rings attached to the internal surface. Both cylinders buckled in a general-instability mode involving buckling of the corrugated wall and reinforcing rings as a composite wall. The buckling strength of the cylinder with rings attached to the external surface was 2.3 times that of the cylinder with rings attached to the internal surface. Both cylinders buckled at approximately 70 percent of the load predicted by the use of a small-deflection buckling theory which included the effect of stiffening ring eccentricity. Author

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N66-38836*# California Univ., Davis.
INFRARED RADIATION MEASUREMENTS OF COMBUSTION GASES Seventh Quarterly Progress Report, 1 Jan.-31 Mar. 1966

W. H. Giedt [1966] 12 p ref
(Contract NAS8-11468)
(NASA-CR-78677) CFSTI: HC $1.00/MF $0.50 CSCL 20M

Reassembly arrangements for the infrared spectral absorption system were evaluated and it was concluded that the furnace should be mounted with its axis horizontal. This system, represented diagrammatically, consists of a high temperature source (a water-cooled globar unit), a graphite resistance heated tube furnace in which the test gas is heated, and a prism-type spectrometer. Diagrams and details are also presented for the design of the test-cell assembly and the box-like optical channel connecting the source and the furnace. N.A.S.

N66-38861*# California Univ., Davis.
INFRARED RADIATION MEASUREMENTS OF COMBUSTION GASES Eighth Quarterly Progress Report, Apr. 1–Jun. 30, 1966
W. H. Giedt [1966] 5 p ref
(Contract NAS8-11468)
(NASA-CR-78678) CFSTI: HC $1.00/MF $0.50 CSCL 21B

The original design of the high-temperature spectral absorption apparatus which will be used to obtain the spectral characteristics of a number of common combustion products under a variety of accurately known thermodynamic and optical conditions, was reviewed. The primary objective of this review was to determine whether modifications could be made to permit absorption measurements at higher temperatures. Two possible arrangements were considered, one with the furnace axis horizontal and the second with the furnace axis vertical. In view of inherent problems associated with a vertical arrangement, the furnace was mounted so that its axis was horizontal. Components were fabricated and the apparatus was assembled. The test cell assembly which defines the optical test path is essentially the same. Minor changes made included the use of springs in place of bellows and the elimination of the kovar extension tubes. Initial testing indicated that the furnace heating element was not working properly. Malfunctioning is attributed to cracks which may have developed during previous operation or during moving. Initial tests with carbon monoxide will resume after this element is inspected. S.C.W.

N66-39077# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON COOLING BY RADIATION OF GAS, FLOWING PAST A FLAT PLATE
A. F. Kurbatskiy and A. T. Onufriyev *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 112–119 refs (See N66-39068 24-23) CFSTI: HC $7.00/MF $1.75

Different approximation methods are compared for solving the simple problem of a thermal boundary layer. An example is given to show the influence of radiation on the magnitude of the energy flux, depending upon the parameter characterizing the relative magnitude of densities of energy fluxes caused by radiation and thermal conduction ϵ. Results of the calculations are plotted. Comparisons of the curves show that for small values of parameter ϵ the difference between the results of the diffusional approximation and the nonlinear thermal conduction approximation may be significant. It is also shown that the magnitude of density of the total energy flux, when the thermal conduction was ignored, is close to the diffusional approximation solution. When thermal conduction was considered, only a certain redistribution in energy fluxes occurred. M.G.J.

N66-39078# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LAMINAR BOUNDARY LAYER IN A RADIATING ABSORBING GAS NEAR A FLAT PLATE
V. P. Zamurayev *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 120–133 refs (See N66-39068 24-23) CFSTI: HC $7.00/MF $1.75

A laminar boundary layer near a plate is considered for the case where heat transfer is carried out by normal thermal conduction and radiation. Several simplifying assumptions are made concerning radiation: the medium is assumed to be gray, the wall an ideal black; physical properties are temperature dependent; and radiant fluxes across the plate are disregarded in comparison with fluxes across it. The hypothesis of local thermodynamic equilibrium is used; emissivity and the coefficient of absorptions are connected by Kirchhoff's law. The character of asymptotic behavior of heat transfer far from the front point of the plate is shown. For solving the problem along the whole plate, a differential method of solution is applied to a system of partial differential equations with a complex integro-differential equation of energy. An example is included to show the character of heat transfer and the possibility of accounting for radiation by approximating radiant thermal conduction. M.G.J.

N66-39084# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A THEORY OF THERMAL EXPLOSION IN UNSTEADY STATE
V. V. Barzykin, V. T. Gontkovskaya, A. G. Merzhanov, and S. I. Khudyayev *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 196–209 refs (See N66-39068 24-23) CFSTI: HC $7.00/MF $1.75

Computers are used to analyze and solve the system of equations of thermal explosion in partial derivatives for a reaction of the zero and first order during conductive heat transfer in the reaction zone and Newtonian heat exchange on the boundary. Also determined are the basic characteristics of thermal explosion. The obtained results are presented in the form of approximate formulas, relating characteristics of thermal explosion with all parameters of the problem in a wide range of their variation. The criterion is given for applying the equation averaged by volume for calculation of the period of induction in the case of conductive heat transfer in a reaction volume. A method of averaging the system of equations of thermal explosion is presented. Author

N66-39085# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE BURNING VELOCITY OF POWDER UNDER VARIABLE PRESSURE
Ya. B. Zel'dovich *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 210–232 refs (See N66-39068 24-23) CFSTI: HC $7.00/MF $1.75

The dependence of burning velocity on pressure is traced for the cases of steady-state regime, and very rapid pressure change. Simplying assumptions are presented to show that the relaxation time of the gasification zone of powder can be ignored, and the zone can be related to the gas layer above the surface of the powder. It is pointed out that the thermal state of the heated layer nearest to the powder should be determined by only one magnitude—the temperature gradient at the surface. This quantity characterizes the heat transfer from the gas, and the gasification zone into the heated layer of powder. Thus, at each moment the burning velocity is determined by the current value of pressure above the powder surface and the magnitude of the temperature gradient at the surface. This distribution of temperature in the powder is found by solving the problem of thermal conduction for a body, extended in one direction and limited in the other by a surface of given temperature gasification moving by a given law. M.G.J.

N66-39086# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN APPROXIMATE METHOD IN THE THEORY OF UNSTEADY BURNING VELOCITY OF POWDER

A. G. Istratov, V. B. Librovich, and B. V. Novozhilov *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 233–242 refs (See N66-39068 24-23) CFSTI: HC $7.00/MF $1.75

A method of approximating integral relations was used to derive analytic expressions for the unsteady burning velocity of a powder, whose burning velocity is determined only by pressure and the temperature gradient at the surface of the condensed phase. Cases of instantaneous and exponential changes of pressure are considered, and conditions were obtained for extinguishing the powder during decrease of pressure. Comparisons with results of numerical calculations are drawn. Also investigated are the linear and exponential dependences of steady burning velocity of powder on its initial temperature. M.G.J.

N66-39087# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INFLUENCE OF PRESSURE ON THE NORMAL VELOCITY OF THE FLAME OF A METHANE–AIR MIXTURE

V. S. Babkin, L. S. Kozachenko, and I. L. Kuznetsov *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 243–252 refs (See N66-39068 24-23) CFSTI: HC $7.00/MF $1.75

The influence of pressure and temperature on the normal velocity of the flame in a methane–air mixture is studied with the help of a bomb of constant volume in the pressure range 1–60 atm (abs.) and temperature range 16°–220°C. The apparent velocity was determined in the initial section by means of high-speed filming using an optical schlieren system. Normal velocity was calculated as the result of division of apparent velocity by the calculated coefficient of expansion. In the pressure range 3–60 atm (abs.) the normal velocity obeys dependence $S_u \approx p^{-0.5}$. Author

N66-39088# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DEPENDENCE OF THE BURNING VELOCITY OF VARIOUS FUEL SYSTEMS ON INITIAL TEMPERATURE

A. D. Margolin, O. N. Nefedova, and P. F. Pokhil *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 253–261 refs (See N66-39068 24-23) CFSTI: HC $7.00/MF $1.75

Experiments were conducted to determine the dependence of burning velocity on initial temperature (from −140° to +150° C) for such classes of fuel systems as hexogene; mixtures of potassium perchlorate with tungsten and zirconium; and the mixture of potassium perchlorate with potassium benzoate. The composition of the mixture, density of substance, and initial pressure were varied. Results showed that the logarithm of the burning velocity u(lg u) of hexogene, and of mixtures of potassium perchlorate with metals is linearly connected with the initial temperature of the substance T_0. The dependence $\lg u = f(T_0)$ of the potassium perchlorate–potassium benzoate showed a discontinuity. The findings are assessed in relation to the hypothesis that in the region of the discontinuity the leading role passes from one spatial stage of burning to another. M.G.J.

N66-39089# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

STUDY OF THE TEMPERATURE DISTRIBUTION DURING BURNING OF AMMONIUM PERCHLORATE

V. K. Bobolev, A. P. Glazkova, A. A. Zenin, and O. I. Leypunskiy *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 262–274 refs (See N66-39068 24-23) CFSTI: HC $7.00/MF $1.75

A method of embedding thin thermocouples into ammonium perchlorate samples is described, and details are given on the techniques used in studying temperature distribution during burning. Temperature profiles and distribution of heat emission rates during burning in the stable region are determined, along with pressure dependence of total heat emission, heat emission in the gas and condensed phases, and heat increment from the gas phase. The relationship of increased burning velocity to pressure is considered, and several hypotheses proposed to explain this phenomenon are assessed. Among the results reported are: (1) Temperature profiles were obtained in pressure regions of 40 to 350 atm, which show the presence of two burning regimes in ammonium perchlorate—stable (40 to 150 atm), and unstable (160 to 350 atm). (2) Anomalous pressure dependences were fixed for surface temperature and heat emission in the condensed phase. (3) The fact of significant divergence between kinetics of thermal decomposition and kinetics of gasification of perchlorate during burning was ascertained. M.G.J.

N66-39341*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

IGNITION KINETICS OF CARBON MONOXIDE–OXYGEN REACTION

Richard S. Brokaw Washington, NASA, Oct. 1966 22 p refs Presented at 11th Intern. Symp., on Combustion, Berkeley, Calif., 14–20 Aug. 1966

(NASA-TN-D-3664) CFSTI: HC $1.00/MF $0.50 CSCL 20M

An analytic solution for the ignition kinetics of the dry carbon monoxide–oxygen reaction is obtained by assuming an initiation reaction followed by the chain-branching steps $CO+O \rightarrow CO_2$ and $CO_2+O_2 \rightarrow CO_2+2O$ together with chain termination by quenching of the electronically excited carbon dioxide molecule, CO_2 and the three-body recombination of carbon monoxide and oxygen atoms. It is concluded that shock-tube induction times on reportedly dry carbon monoxide–oxygen mixtures cannot be explained by this mechanism. The shock-tube data can be explained by the following scheme, if a water vapor content of 20 parts per million or less is assumed: $CO+O_2 \rightarrow CO_2+O$, $O+H_2O \rightarrow 2OH+CO \rightarrow CO_2+H$, $H+O_2 \rightarrow OH+O$. The rate constant for the initiation reaction was found to be $2.5\times10^9 \exp(-48{,}000/RT)$ liters per mole-second. The rate constant for the reaction between oxygen atoms and water at 1600°K was estimated by two different methods to be 8×10^8 and 1.5×10^9 liters per mole-second. Induction periods for mixtures with deliberate additions of hydrogen can be fit by adding the steps $O+H_2 \rightarrow OH+H$ and $OH+H_2 \rightarrow H_2O+H$. Author

N66-39369# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

NON-STATIONARY TEMPERATURE FIELDS IN COOLED DISKS

V. I. Van'ko *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 287–293 refs (See N66-39346 24-23) CFSTI: HC $7.00/MF $1.50

An unsteady thermal process in two disks without central drilling is analyzed. Consideration is given to solid disks, disks of hyperbolic profile, and disks of constant cross-sectional thickness. The mathematical calculations for temperature fields are shown, and a table containing the roots of characteristic equations is presented. A.G.O.

N66-39370# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INFLUENCE OF LIGHT RADIATION ON THE RATE OF BURNING OF NITROGLYCERINE POWDER

E. V. Konev and S. S. Khlevnoy *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 294–300 refs (See N66-39346 24-23) CFSTI: HC $7.00/MF $1.50

Data are presented from experiments formulated to study the mechanism of the direct influence of a luminous flux which varies

in intensity, on the process of burning nitroglycerine powder. A dependence was obtained of the powder burning rate on the density of the luminous flux at atmospheric pressure. It was determined that this dependence was especially strong for low densities of the luminous flux. Results also indicate that the powder burning rate on the density of the luminous flux at atmospheric pressure. It was determined that this dependence was especially strong for low densities of the luminous flux. Results also indicate that luminous flux has not only a thermal effect on the burning process, but has significant direct influence on the luminous flux has not only a thermal effect on the burning process, but has significant direct influence on the chemical process kinetics in the leading zone of burning, increasing in it the rate of the reaction flow. chemical process kinetics in the leading zone of burning, increasing in it the rate of the reaction flow. A.G.O.

N66-39371# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE STRUCTURE OF A FLAME FRONT

A. S. Pleshanov *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 301–308 ref (See N66-39346 24-23) CFSTI: HC $7.00/MF $1.50

Two approximations are presented which demonstrate solutions of hydrodynamic equations with respect to chemical reactions. It is noted that in the stationary case the pressure in front of the flame front, which varies proportionally with the square of the Mach number, increases when the Prandtl number is greater than one or decreases when the number is less than one. The nonstationary system of equations outside the flame front is also considered, and qualitative distributions of temperature, pressure, density, and velocity are given with respect to the flow. A.G.O.

N66-39372# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ESTIMATION OF THERMAL EFFECT OF THE INITIAL STAGE OF BURNING OF POWDERS AND EXPLOSIVES

V. M. Mal'tsev and P. F. Pokhil *In its* J. of Appl. Mech. and Tech. Phys. 28 Feb. 1966 p 309–313 refs (See N66-39346 24-23) CFSTI: HC $7.00/MF $1.50

It is established that during the burning process of powder, the specific weight of heat liberated in the reaction layer of the condensed phase increases with pressure growth. Experiments were conducted with samples of hexogene, and measurements of temperature and absorbing ability at the height of a flame jet are shown. Research results lead to the conclusion that the region of initial burning in secondary explosives is in the reaction layer of the condensed phase, and heating of hexogene in the process of burning is from the flux of heat from the gas phase and the thermal effect of the initial stage of burning. The amount of heat liberated in the charged stage of powder burning and its role in the balance of heat, going to heat the powder in the burning process significantly exceeds, in the investigated pressure range, the quantity and role of heat liberated in the reaction layer of the condensed phase during the burning of hexogene. A.G.O.

N66-39381*# Alabama Univ. Research Inst., Huntsville.

UNSTEADY HEAT TRANSFER FROM A ROTATING DISK DUE TO A STEP CHANGE IN LOCAL WALL HEAT FLUX WITH LARGE SUCTION

D. R. Jeng and Y. V. Subba Rao Jun. 1966 49 p refs (Grant NsG-381)

(NASA-CR-78762; UARI-27) CFSTI: HC $2.00/MF $0.75 CSCL 20M

An analysis is made for the unsteady heat-transfer, due to a time dependent wall heat flux, from an infinite disk, rotating in still fluid with large suction. The procedure begins with a consideration of the thermal response caused by a step change in the local wall heat flux. It is found that the response time varies inversely with the Prandtl number, the angular velocity and the second power of the suction parameter. Incompressible flow with dissipation is considered first. For an ideal gas with constant Prandtl number whose viscosity varies linearly with temperature, the incompressible results may be, if dissipative effect can be ignored, directly applied provided that all properties in the solution are replaced by their wall values. Author

N66-39498# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EFFECT OF THERMAL RESISTANCE OF COATINGS ON THE THERMAL RADIATION CHARACTERISTICS OF STAR LIKE RADIATORS

Yu. A. Vasanov 23 Feb. 1966 14 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Energ. i Transp. (Moscow), no. 6, 1964 p 743–749

(FTD-TT-65-1389; TT-66-62084; AD-637383) CFSTI: HC $1.00/MF $0.50

Discussed is the problem of considering the effect of thermal resistance of coatings, used for increasing the degree of blackness of a radiation surface, upon the characteristics of thermal radiation of star like radiators. Analysis is made in simultaneous approximation at conditions that in the direction of rib length, the temperature gradient in the coating is negligibly small. Presented are results of solving for a four comb star like radiator. Author (TAB)

N66-39522# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

IGNITABILITY OF ALLOYS OF THE ZIRCONIUM–TITANIUM SYSTEM

V. G. Ioffe 23 Feb. 1966 12 p refs Transl. into ENGLISH from Izd. Vysshikh Uchebn. Zavedenii, Tsvetn. Met. (Dzaudzhikau), no. 6, 1964 p 125–130

(FTD-TT-65-1473; TT-66-62106; AD-637433) CFSTI: HC $1.00/MF $0.50

The autoignition temperature of zirconium with titanium alloys was determined experimentally and an ignition diagram of the Zr-Ti system was formulated. An approximate expression of the autoignition temperature dependence of the alloy upon its composition was found and it was established that Zi-Ti, Ti-Al, and Ti-Mn systems satisfactorily submit to that dependence. Ignition of Zr-SI and Ti-Si alloys deviates sharply from the found dependence which is presumably explained by the formation of high melting silicides Author (TAB)

N66-39523# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ANALYSIS OF METHODS OF DETERMINING LOSSES OF FUEL DUE TO MECHANICAL INCOMPLETENESS OF COMBUSTION

L. V. Kulagin, K. F. Dobrikiv, and S. S. Okhotnikov 1 Apr. 1966 20 p refs Transl. into ENGLISH from Vses. Nauchn. Issled. Inst. Zheleznodorozhnogo Transp. (Moscow), issue 264, 1964 p 30–40

(FTD-MT-65-327; TT-66-62101; AD-637428) CFSTI: HC $1.00/MF $0.50

Consideration is given to the effectiveness of various optical, calorimetric, mechanical, and chemical methods for determining the magnitude of losses due to mechanical incompleteness of combustion in furnace devices. TAB

N66-39546# Denver Research Inst., Colo.

PROCESS OCCURRING IN PYROTECHNIC FLAMES Final Report, Aug. 1964–Feb. 1966

Robert M. Blunt Crane, Ind., Naval Ammunition Depot, Apr. 1966 102 p refs *Its* Rept.-480-6604-F
(Contract N164-10520)
(RDTR-35; AD-637512) CFSTI: HC $4.00/MF $0.75

The research was to acquire information that could be used to improve the luminosity and color of illuminating and signalling pyrotechnic compositions used in flare production. The following observations and conclusions were made: (1) A sharp degradation of luminosity occurs at low ambient pressures. (2) The excitation purity (color) was observed to increase as the pressure decreased. (3) The time required to burn a 10 gram mass was found to increase as the ambient pressure decreased. (4) The temperature measurements are in agreement with the luminosity findings, i.e., temperature decreases with decreasing pressure. (5) A test confirmed the hypothesis that the BaOH molecule is the source of the green color in Ba-containing flares. (6) The changes in luminosity and burning rate were explained by an hypothesis relating reaction rate to pressure of ambient atmosphere. (7) The observed burning rates and luminosity were expressed in mathematical form which may be helpful in future design studies. (8) A photographic atlas of spectra of flares containing barium and sodium was assembled covering the 3,700A to 7,400A region. TAB

N66-39562# Combustion Engineering, Inc., Windsor, Conn. Steam and Water Div.
A RESEARCH STUDY ON INTERNAL CORROSION OF HIGH PRESSURE BOILERS
P. Goldstein [1966] 29 p Sponsored by ASME and Edison Elec. Inst.
(PR-2; AD-637754) CFSTI: HC $2.00/MF $0.50

The report describes the results of the first half of the study. Results of tests with volatile, coordinated phosphate, and caustic boiler water treatment under conditions simulating a boiler with clean internal surfaces and one whose surfaces have been fouled with typical preboiler corrosion products, are included. Data relating to deposition and corrosion in the above environments are presented. The corrosion failure of a test tube due to caustic gouging and the discovery of an unusual effect of deposits on boiling characteristics are described. Author (TAB)

N66-39633# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RE-ENTRY HEATING OF SPACE VEHICLES
8 Apr. 1966 6 p Transl. into ENGLISH from Tekhn. Molodezhi (Moscow), no. 4, 1965 p 8
(FTD-TT-65-1765; TT-66-62111; AD-637438) CFSTI: HC $1.00/MF $0.50

Translation of Russian research: re-entry heating of space vehicles. Author (TAB)

N66-39640# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COOLING OF GAS TURBINE COMPONENTS SUBJECT TO HIGH TEMPERATURES
Karoly Pahota 26 Mar. 1966 15 p refs Transl. into ENGLISH from Energia Atomtech. (Budapest), no. 2, 1964 p 26 Mar. 1966 15 p refs Transl. into ENGLISH from Energia Atomtech. (Budapest), no. 2, 1964 p 62-66
(FTD-TT-65-1216; TT-66-62115; AD-637442) CFSTI: HC $1.00/MF $0.50

The construction of high-temperature gas turbines is a practical possibility; the turbines offer economy with internal cooling for rotor blades made of presently available materials. Internal cooling gives satisfactory results with both single-circuit and double-circuit cooling systems. In the single-circuit system, the heat carrier may be either air, water or saturated steam; in the double-circuit system, it is a liquid metal in the primary circulation and any of the heat carriers used in the single-circuit system in the secondary circuit. Water-cooling of the blades encounters serious design difficulties. It is economical to use air if the amount of heat to be taken off is small. It is economical to use saturated steam to remove small amounts of heat, especially in case of exhaust cooling systems. The dimensions of the radiator or the size of the heat-transfer area may be reduced by the use of cooling steam in double-circuit systems. In the case of higher output, or if a considerable amount of heat is to be removed, it is feasible to supply the heated (super-heated) steam from the cooling system to a waste-heat condensation turbine. In compounded steam/gas turbine installations, where the cooling system forms large amounts of steam, intermediate cooling-system super-heaters may also be used. Author (TAB)

N66-39656# Bureau of Mines, Bartlesville, Okla. Petroleum Research Center.
THERMODYNAMIC PROPERTIES OF COMPRESSED GASES Annual Technical Summary Report, 12 Apr. 1965-31 May 1966
D. R. Douslin, R. H. Harrison, and R. T. Moore 1966 36 p
(AFOSR-66-1784; AD-637567) CFSTI: HC $2.00/MF $0.50

The purpose of the project is to provide reliable values for the thermodynamic properties of key compressed gaseous systems which can be used as points of reference for a better understanding of the laws of mixing. For several reasons the binary system, methane-tetrafluoromethane, fulfills the requirements of a key system for which a detailed study is justified. The molecules of both methane and tetrafluoromethane are quasi-spherical, possess similar skeletal structures, correspond to a simple interaction model, and can be expected, therefore, to respond reasonably well to a theoretical interpretation of the results. Accurate P-V-T data are available for this system over wide temperature and pressure ranges. Also, both substances are stable at high temperatures thus making possible extended experimental studies. During the reporting period thermodynamic properties for pure methane, pure tetrafluoromethane, a 50% methane - 50% tetrafluoromethane mixture, and a 25% methane - 75% tetrafluoromethane mixture were completed. Similar calculations for the 75% methane 25% tetrafluoromethane mixture are in progress. (Author) TAB

N66-39682# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THEORY AND ANALYSIS OF STRAIGHT-THROUGH-FLOW COMBUSTION CHAMBERS
S. M. Il'yashenko and A. V. Talantov 7 Apr. 1966 295 p refs Transl. into ENGLISH of the book "Teoriya i Raschet Pryamotochnykh Kamer Sgoraniya" Moscow, Izd. Mashinostr., 1964 p 1-306
(FTD-MT-65-143; TT-66-62119; AD-637446) CFSTI: HC $6.00/MF $1.50

Contents: Discharge and atomization of liquid fuel; Ballistics of nonvaporizing drops; Evaporation of drops; Calculation of fields of concentrations of a fuel-air mixture; The theory of turbulent combustion of a homogenous mixture; Experimental investigations of burning in a turbulent flow of homogeneous mixture; Position of the flame in the combustion chamber; Flame stabilization; Burning of two-phase mixtures. TAB

N66-39708*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
MEASUREMENT OF THERMAL CONDUCTANCE OF MULTILAYER AND OTHER INSULATION MATERIALS Final Report, Oct. 22, 1964-Dec. 31, 1965
Gilbert S. Karp and Erwin Fried 6 Jan. 1966 248 p *Its* Doc.-66SD4207
(Contract NAS9-3685)
(NASA-CR-78979) CFSTI: HC $6.00/MF $1.50 CSCL 20M

A total of 53 multilayer thermal insulation conductance tests for varying temperature limits, thicknesses, and lay-ups were performed on the double sample, guarded hot plate apparatus at steady-state conditions. Outside garment temperature limits were −310°F, −100°F, +200°F, and +300°F, for most cases, with the inside garment temperature at 0°F or 70°F in most cases. The suit material lay-up thickness varied from 1/8 inch to 5/16 inch. Two basic multilayer material combinations were evaluated. The first was the current Gemini extravehicular suit lay-up consisting of seven layers of aluminized (one side only) Mylar, separated by nonwoven Dacron, several layers of HT-I Nylon, bladder cloth pressure layer, and a felt meteoroid protection layer. The second lay-up was similar to the previous material combination. The number and type of the multilayer insulation were variables of interest in the test program. One result observed was the dependency of the overall thermal conductance on the material compression. It was observed that the substitution of aluminized polyester film for the nonwoven Dacron spacers resulted in equal or better thermal performance. Author

N66-39712*# Bureau of Mines, Pittsburgh, Pa.
SUMMARY OF LITERATURE SURVEY OF HYPERGOLIC IGNITION SPIKE PHENOMENA, PHASE I Final Report, Apr. 8–Dec. 31, 1965
Henry E. Perlee and Theodore Christos [1965] 48 p refs
(NASA Order T-39882(G))
(NASA-CR-78986) CFSTI: HC $2.00/MF $0.50 CSCL 21B

The results of the search of literature and industry are summarized. The problem is defined and the various physical and chemical processes occurring in the engine complex that would contribute to a hard start are discussed. The mechanics and scope of the industry survey and literature search are described. The physics of spray formation, chemistry of combustion, physicochemistry, and gas dynamics and transport are dealt with; information available in the literature on these subjects and the information gaps in each problem area are summarized. Author

N66-39728# Case Inst. of Tech., Pittsburgh, Pa. Engineering Div.
EXPERIMENTAL STUDIES OF NATURAL CONVECTION IN A HORIZONTAL CYLINDER
Ali Savzevari and Simon Ostrach Jun. 1966 81 p refs
(Grant AF-AFOSR-194-66)
(FTAS/TR-66-8; AFOSR-66-140; AD-637586) CFSTI: HC $3.00/MF $0.75

An experimental investigation was conducted to study the natural convection of a high kinematic viscosity oil enclosed in a horizontal cylinder. The circumferential wall of a 5 in. I. D. copper cylinder was heated according to a cosine temperature distribution. The maximum and minimum temperatures on the cylinder wall were chosen for large Prandtl numbers and unit order Grashof numbers. The experimental equipment was so designed that a variety of heating configurations could be investigated, namely, ranging from the heating-from-the-side to the heating-from-below case. For several heating configurations, detailed velocity and temperature measurements were performed over the entire cross section of the midplane between the two ends of the cylinder. The physical nature of the core region and of the boundary layer region were studied in each considered case. Some of the experimental results were compared with the theory, which had been established previously for this problem Author (TAB)

N66-39754# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXPERIMENTAL INVESTIGATION OF WATER VAPORIZATION IN A NONISOTHERMAL TURBULENT BOUNDARY LAYER
B. I. Fedorov 21 Mar. 1966 16 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (USSR), v. 7, no. 1, 1964 p 21–27
(FTD-TT-65-1974; TT-61-22217-3; AD-637443) CFSTI: HC $1.00/MF $0.50

The paper reports the results on an investigation of water transpiration cooling of a ceramic plate surface in a gradient dry air flow under the conditions of a turbulent boundary layer. The ambient temperature changed from 50° to 130°C, the humidity being about 1 - 3 percent. Heat and mass transfer coefficients were determined by both heat-substance balance at the wall and boundary-layer reading. As a result dimensionless formulas were obtained to describe a change in the combined heat and mass transfer rate under the above conditions. Estimated is the influence of the longitudinal pressure gradient and medium turbulization on transpiration cooling. Author (TAB)

N66-39767# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EFFECT OF A NONISOTHERMAL SURFACE ON HEAT EXCHANGE OF A PLATE IN A LONGITUDINAL FLOW
A. A. Zhukauskas, A. B. Ambrazyavichyus, and I. I. Zhyugzhda 21 Mar. 1966 11p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (USSR), v. 7, no. 4, 1964 p 3–7
(FTD-TT-65-1975; TT-66-62088; AD-637388) CFSTI: HC $1.00/MF $0.50

The heat exchange of a plate in a laminar flow of air, water and transformer oil at q sub w = const was experimentally investigated. The effect of an initial unheated section was studied both in a laminar and in a turbulent boundary layer Author (TAB)

N66-39785# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
AN EXTENDED TABLE OF ZEROS OF CROSS PRODUCTS OF BESSEL FUNCTIONS
Henry E. Fettis and James C. Caslin Feb. 1966 135 p refs
(ARL-66-0023; AD-637474) CFSTI: HC $4.00/MF $1.00

The report contains tables of the first five roots of the following transcendental equations: (a) J0(alpha) Y0(alpha) = Y0(alpha) J0(alpha); (b) J1(alpha) Y1(alpha) = Y1(alpha) J1(alpha); (c) J0(alpha) Y1(alpha) = Y0(alpha) J1(alpha) where J0(alpha), Y0(alpha), J1(alpha), Y1(alpha) are Bessel functions of order 0 and 1 respectively. In these equations, alpha is the unknown and k is a parameter which may assume any positive value, other than 0 or 1. Additional tables are included listing an auxiliary quantity gamma which is better suited to interpolation particularly when k is close to unity. (Author) TAB

N66-39834# Kyoto Univ. (Japan). Dept. of Aeronautical Engineering.
AN EXPERIMENTAL INVESTIGATION OF SEVERAL ABLATION MATERIALS IN A PLASMA JET WIND TUNNEL
Goro Kamimoto and Yoshitaka Uenaka Jun. 1966 24 p refs
(CP-11) CFSTI: HC $1.00/MF $0.50

A priori knowledge of the response of materials subjected to a severe aerothermal environment is essential in the space age. Therefore the ablation characteristics of several reinforced plastics were investigated, utilizing an arc-heated wind tunnel. The results of ablation are reported as an effective heat of ablation which represents the heat blocked or absorbed per unit ablated mass. Six kinds of plastics are investigated. They are Nylon, Teflon, glass fiber reinforced Teflon, and glass cloth reinforced-epoxy, -phenolic and -silicon resin. Author

N66-39871# Rocket Propulsion Establishment, Westcott (England).
PERCHLORIC ACID FLAMES. PART III: SOME FLAME TEMPERATURES AND BURNING VELOCITIES
G. A. McD. Cummings and A. R. Hall London, Min. of Aviation, Sep. 1965 20 p refs
(RPE-TR-65/5) CFSTI: HC $1.00/MF $0.50

Burning velocities, spectra and temperatures have been obtained for some flames of perchloric acid with methane, ethane,

methyl alcohol and carbon monoxide, mainly at atmospheric pressure. The burning velocity is three times greater than with the corresponding flames with oxygen, the maximum velocity being attained with a mixture that is appreciably more fuel rich than the one which has the highest theoretical flame temperature. Cool flame emission seems characteristic of flames with hydrocarbon fuels. The measured temperatures are close to the theoretical values. The chemical processes in perchloric acid flames are discussed in the light of these and other results. Author

N66-39904*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL INVESTIGATION OF TRANSVERSE-MODE SOLID-PROPELLANT COMBUSTION INSTABILITY IN A VORTEX BURNER
Louis A. Povinelli, Marcus F. Heidmann, and Charles E. Feiler Washington, NASA, Nov. 1966 36 p refs
(NASA-TN-D-3708) CFSTI: HC $2.00/MF $0.50 CSCL 21B

Transverse mode combustion instability was investigated by using a two-dimensional vortex of pancake-type combustor in which the oscillations were caused by a swirling tangential flow supplied by a progressively burning gas generator. The pressure level, pressure amplitude, and frequency of oscillation were measured for various propellant compositions and motor nozzle diameters. Fundamental changes in the propellant flame behavior were made by changing the oxidizer particle size and the pressure. The data were interpreted in terms of a calculated response function based on the Rayleigh, criterion for wave amplification. Use of radially drilled rings was effective in eliminating instability. The damping effect was consistent with the postulated driving mechanism. Author

N66-39943*# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
BUBBLE FORMATION AND GROWTH: STUDY OF THE BOUNDARY CONDITIONS AT A LIQUID-VAPOR INTERFACE THROUGH IRREVERSIBLE THERMODYNAMICS Quarterly Progress Report, Jun.-Aug. 1966
Robert R. Adt, Jr., Walter J. Bornhorst, and George N. Hatsopoulos Sep. 1966 11 p refs
(Contract NAS8-20013)
(NASA-CR-79105) CFSTI: HC $1.00MF $0.50 CSCL 20M

This report treats mainly the experimental part of the program. An experimental apparatus was designed to measure the previously defined transport coefficient by means of the steady state evaporation experiment. Mercury was chosen as the working fluid. A heated nickel block will supply the evaporation heat. Temperature, pressure, and evaporation rate control arrangements of the apparatus are explained. Assembly and calibration of the system was started. K.W.

N66-39951# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EXPERIMENTAL INVESTIGATION OF THE FORCED- CONVECTION AND NUCLEATE-BOILING HEAT-TRANSFER CHARACTERISTICS OF LIQUID AMMONIA
M. B. Noel 19 Jul. 1961 19 p refs
(Contract NASw-6)
(NASA-CR-79088; JPL-TR-32-125) CFSTI: HC $1.00/MF $0.50 CSCL 20M

The heat-transfer characteristics of commercial-grade anhydrous ammonia have been obtained experimentally by utilizing electrically heated tubes. A total of fifty-five tests were performed, including measurements in the forced-convection nonboiling and forced-convection nucleate-boiling regions. The upper limit of nucleate boiling q_{ul} has been determined for ranges of velocity, pressure, and liquid bulk temperature that include velocities between 0 and 156 ft/sec, pressures between 150 and 1820 psia, and liquid bulk temperatures between 23 and 158°F. The values of q_{ul} varied from 2 to 14 Btu/in.^{2}sec, depending upon the particular flow condition. An interpolation equation is presented that may be used to predict q_{ul} within the ranges of pressure, velocity, and liquid bulk temperature tested. Author

N66-39969*# Arizona State Univ., Tempe. Engineering Research Center.
HEAT TRANSFER CHARACTERISTICS OF ARC TUNNEL CONSTRICTORS
Darryl E. Metzger 15 Aug. 1966 39 p refs
(Contract NAS2-2640)
(NASA-CR-73037; ME-661) CFSTI: HC $2.00/MF $0.50 CSCL 20M

Arc tunnel constrictors have been designed and tested which will tolerate heat fluxes up to 12,000 Btu/(sec ft^2). Thick walled constrictors failed by local melting on the arc side of the wall at flux levels in agreement with predictions based on axisymmetric condition through the wall. Burnout type failures were observed with thinner walled constrictors at flux levels up to four times higher than predicted by Gambill's additive method, and the difference is attributed to high non-boiling convective heat transfer rates. The results of this study indicate that with proper coolant passage design and high coolant pressures, heat fluxes up to 20,000 Btu/(sec ft^2) may be tolerable without constrictor failure. Author

N66-39999*# General Dynamics/Pomona, Calif.
DIRECT MEASUREMENT OF COMPRESSIBLE TURBULENT BOUNDARY LAYER SKIN FRICTION ON A POROUS FLAT PLATE WITH MASS INJECTION Final Report
H. Dershin, C. A. Leonard, W. H. Gallaher, and J. P. Palmer Jul. 1966 52 p refs
(Contract NAS7-294)
(NASA-CR-79095; CR-332-761-001) CFSTI: HC $3.00/MF $0.50 CSCL 01A

An experimental investigation of skin friction on a porous flat plate in supersonic, turbulent flow has been carried out. Useful data has been obtained at Mach number 3.2 (nominal) and at two Reynolds numbers of the order of 10^7. Measurements were made with a skin friction balance which permitted mass injection through its friction surface. The injection gas was nitrogen. The results of the experiments are in essential agreement with the theory of Rubesin as regards skin friction reduction with mass injection. In addition, correlation of the skin friction data with heat transfer measurements tend to verify the "Reynolds analogy" between skin friction and heat transfer. Author

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N66-39001# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SCIENTIFIC TECHNICAL INFORMATION Selected Articles
21 Feb. 1966 39 p refs Transl. into ENGLISH from Nauchn.-Tekhn. Inform., Vses. Inst. Nauchn. i Tekhn. Inform. (Moscow), no. 10, 1964 p 10-14, 19-22
(FTD-TT-65-1084; TT-66-61964; AD-636705) CFSTI: HC $2.00/MF $0.50

CONTENTS:

1. ORGANIZATION AND METHOD OF THEMATIC SEARCH AND CREATION OF INFORMATION PRECEDING NEW DEVELOPMENTS G. I. Gol'dgamer p 1-21 (See N66-39002 24-34)

2. FORCED INSTRUCTION OF A PERCEPTRON WITH THRESHOLD ELEMENTS A. Z. Nepomnyashchiy and L. B. Nisnevich p 22-35 refs (See N66-39003 24-10)

N66-39002# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ORGANIZATIONAND METHOD OF THEMATIC SEARCH AND CREATION OF INFORMATION PRECEDING NEW DEVELOPMENTS

G. I. Gol'dgamer *In its* Sci. Tech. Inform. 21 Feb. 1966 p 1-21 (See N66-39001 24-34) CFSTI: HC $2.00/MF $0.50

Described are experiences of a scientific research institute gained in the field of thematic information search in support of technological projects, research, and investigations. Emphasized is the importance of obtaining information prior to the start of a project, and the effect of searches on subsequent development is demonstrated. Discussed are problems of planning and methods of preparation, including: (1) indicators of thematical literature; (2) reviews; (3) bibliographies and annotations; and (4) translations. K.W.

N66-39004# General Electric Co., Philadelphia, Pa. Missile and Space Div.

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Lawrence I. Chasen Sep. 1966 44 p refs
(R66SD49)

A detailed description of how to order data, scope of collection, subscription services, use of the catalog system and the advanced computer retrieval program is presented. The varied types of documentary reports as generated by NASA, AEC and the Defense Documentation Center (DDC)–which the MSD Library can obtain–are cited. Division procedures on Technical Information are found in the Appendix. Author

N66-39184# Los Alamos Scientific Lab., N. Mex.

THE CURRENT STATUS OF ARCHEOLOGY AT THE NEVADA TEST SITE AND THE NUCLEAR ROCKET DEVELOPMENT STATION

F. C. V. Worman [1966] 30 p refs
(Contract W-7405-ENG-36)
(LA-3520-MS)

The Nevada Test Site and Nuclear Rocket Development Station are categorized by areas of archeological interest. Treatment of the various areas to comply with the directive regarding protection and preservation of antiquities on AEC-owned or controlled property is discussed. Author (NSA)

N66-39300# Naval Research Lab., Washington, D. C.

REPORT OF NRL PROGRESS

Aug. 1966 43 p refs
(PB-170960)

CONTENTS:

1. AN INTERESTING CASE OF CLOSED ATMOSPHERE CONTAMINATION R. A. Saunders p 1-4 ref (See N66-39301 24-05)

2. HIGHLY DIRECTIVE ANTENNAS USED IN NRL'S RADIO ASTRONOMY PROGRAM. PART III: THE EIGHTY-FIVE FOOT RADIO TELESCOPE E. F. Mc Clain p 5-10 refs (See N66-39302 24-07)

3. CHEMISTRY A. G. Sands et al p 11-13

4. MECHANICS N. J. Rendler et al p 13-18 refs

5. METALLURGY AND CERAMICS R. J. Goode et al p 18-32 refs

6. OPTICAL PHYSICS J. A. Curcio p 32-33

7. RADIO H. D. Arnett et al p 33-35

8. SOUND J. J. Gennari et al p 35-36

N66-39331*# Houston Univ., Tex.

MULTIDISCIPLINARY SPACE RELATED RESEARCH Semiannual Progress Report, 1 Mar.-31 Aug. 1966

Sep. 1966 22 p
(Grant NGR-44-005-021)
(NASA-CR-78752) CFSTI: HC $1.00/MF $0.50 CSCL 22A

Utilization of funds provided for developing improved capabilities in physics, chemical engineering, mathematics, and other space related disciplines is outlined. Theoretical and experimental research was initiated in solid-state magnetoacoustics, the diffusion of gases through metals, the microcalorimetric measurement of beta-ray energies, and the mechanism of red light emission in lunar craters. Investigated also were the fluid mechanics of flow systems in the presence of gas liquid interfaces, the nonnegative matrices which are diagonally equivalent to stochastic matrices, and the determination of the minimum permanent of the $n \times n$ double stochastic matrices. R.Ll.

N66-39374*# George Washington Univ., Washington, D. C.

TELEVISION AS A FACTOR IN NATIONAL COHESION IN KENYA AND UGANDA

Benjamin Nimer Jul. 1966 24 p refs
(Grant NsG-727)
(NASA-CR-78765) CFSTI: HC $1.00/MF $0.50 CSCL 05K

The contributions are discussed of television to greater national cohesion as it assists modernizing policies in Kenya and Uganda, and at the same time preserves the indigenous cultural heritage of the various ethnic groups. Kenya's experiment with commercial TV is described, and the effects of the nationalization of TV are suggested. Population patterns and network differences in Kenya and Uganda are mentioned, and the future of Swahili and TV in Kenya and Uganda are considered. A.G.O.

N66-39414# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ORGANIZATION AND USE OF A CENTRAL SPECIAL REFERENCE COLLECTION; MATERIAL FROM SCIENTIFIC TECHNICAL CONFERENCE Selected Articles

2 Mar. 1966 22 p Transl. into ENGLISH from Sozdaniye i Ispol'z Tsentr. Ostraslevogo Spravochno-Inform. Fonda Mater. Nauchno-Tekhn. Soveshch. (Moscow), 1964 p 55-59, 70-73
(FTD-TT-65-1291; TT-66-61955; AD-636669) CFSTI: HC $1.00/MF $0.50

CONTENTS:

1. ACCOUNTING SCIENTIFIC-TECHNICAL DOCUMENTATION AS A BASIS OF FULFILLING REFERENCE-INFORMATION FUNDS A. A. Prikhod'ko p 1-8 (See N66-39415 24-34)

2. EXPERIENCE IN INTRODUCING BRANCH UDK TABLES ON MACHINE CONSTRUCTION A. A. Leonova p 9-14 (See N66-39416 24-34)

N66-39415# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ACCOUNTING SCIENTIFIC-TECHNICAL DOCUMENTATION AS A BASIS OF FULFILLING REFERENCE-INFORMATION FUNDS

A. A. Prikhod'ko *In its* Organ. and Use of a Central Spec. Reference Collection; Mater. from Sci. Tech. Conf. 2 Mar. 1966 p 1-8 (See N66-39414 24-34) CFSTI: HC $1.00/MF $0.50

The need for timely and accurate reporting of scientific and technical information is discussed. If a particular research project takes many years to complete, the value of a finding at the beginning of the project may be lost if one waits until the completion of the project before the finding is documented. A system proposed and used by the Soviet Union for disseminating technical information is described and assessed. H.S.W.

N66-39416# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EXPERIENCE IN INTRODUCING BRANCH UDK TABLES ON MACHINE CONSTRUCTION

A. A. Leonova *In its* Organ. and Use of a Central Spec. Reference Collection: Mater. from Sci. Tech. Conf. 2 Mar. 1966 p 9-14 (See N66-39414 24-34) CFSTI: HC $1.00/MF $0.50

The use of the universal decimal classification system in preparing an index is discussed. It is shown that this system may be subdivided so that all information pertaining to one particular subject will be in one place in the file. It is pointed out however, that subject matter must be properly identified when using this system. H.S.W.

N66-39495# National Opinion Research Center, New York.

COMMUNITY REACTIONS TO SONIC BOOMS IN THE OKLAHOMA CITY AREA. VOLUME III: QUESTIONNARIES. APPENDIX TO VOLUME II Final Report, Apr. 1963-Feb. 1965

Paul N. Borsky Wright-Patterson AFB, Ohio, AMRL, Mar. 1966 60 p

(Contract AF 33(657)-11148)

(AMRL-TR-65-37, Vol. III; AD-637563) CFSTI: HC $3.00/MF $0.75

The appendix contains samples of questionnaries used during the interviews that took place from February to July 1964 in the Oklahoma City, Oklahoma area. That area was repeatedly exposed to sonic booms generated to simulate overpressure levels that are expected for supersonic transport overflights. The schedule provide for eight sonic booms per day. During the 6-month period, almost 3,000 local residents were interviewed three times to determine the nature and extent of their reactions to the sonic booms.

Author (TAB)

N66-39786# Miami Univ., Coral Gables, Fla.

NINTH AFOSR CONTRACTORS' MEETING ON ION AND PLASMA PROPULSION

Daniel R. Wells et al [1966] 45 p refs Meeting held 21-23 Mar. 1966

(Grant AF-AFOSR-844-65)

(AFOSR-66-1363; AD-637697) CFSTI: HC $2.00/MF $0.50

The document contains the summaries of the papers presented at the Ninth Annual AFOSR Contractors' Meeting on Ion and Plasma Propulsion in Coral Gables, Florida. The paper deals mostly with basic research on plasma power generation and propulsion.

Author (TAB)

N66-39805# Cornell Univ., Ithaca, N. Y. Dept. of Industrial Engineering and Operations Research.

OPTIMAL SEQUENTIAL PLANS BASED ON PRIOR DISTRIBUTIONS AND COSTS

Mainak Mazumdar (Ph.D. Thesis) Apr. 1966 148 p refs

(Contract Nonr-401(53); Grant NSF GP-3783)

(TR-3; AD-634341) CFSTI: HC $4.00/MF $1.00

A. Hald in Technometris, Vol. 2, No. 3 proposed a model of sampling inspection by attributes. He postulated certain definite forms for the losses which are associated with the acceptance or rejection of a lot, and for the cost of taking a single observation. He further assumed that there exists an a priori distribution of the number of defectives, the distribution being known to the experimenter. Under these assumptions he derived the associated single sampling plans which minimize the expected costs averaged with respect to the known a priori distribution. J. Pfanzagl in Technometrics, Vol. 5, No. 2 specialized Hald's model by considering a particular type of a priori distribution, and obtained the double sampling plans which are optimal in the same sense. In this paper, Pfanzgl's work has been generalized by extending his results to sequential plans, in particular, the related optimal (Bayes) sequential sampling plans and their operating characteristics are derived. The Bayes risks of the optimal sequential plans are compared with those of the corresponding optimal single sampling plans for certain representative values of the parameters. The limiting behavior for large lots of the optimal boundaries for the sequential sampling plans is studied using a particular normalization due to Chernoff and Ray. (Annals of Math. Stat., Vol. 36, No. 5).

Author (TAB)

N66-39946*# National Aeronautics and Space Administration, Washington, D. C.

[EDUCATED MANPOWER AND THE PROBLEMS OF THE SPACE AGE]

James E. Webb 28 Oct. 1966 9 p Presented at Oakland, Calif. 28 Oct. 1966 Available from the Scientific and Technical Information Division CSCL 22A

The role of space science and technology in helping to solve problems of society; the development of better relations between science, education, industry, and government; the interdisciplinary approach to space program problems, the importance of colleges and universities in conducting basic research and engineering development as well as supplying skilled manpower; the need for more professional women in the space program; the organizational and management resources gained in the space effort and their implications; and non-space applications of the space program in vocational rehabilitation and education are briefly discussed. R.N.A.

N66-39947*# National Aeronautics and Space Administration, Washington, D. C.

DEDICATION OF SPACE SCIENCE LABORATORY, UNIVERSITY OF CALIFORNIA, BERKELEY

James E. Webb 27 Oct. 1966 12 p Available from the Scientific and Technical Information Division CSCL 22A

The role of the University of California's new Space Science Laboratory in advancing the scientific disciplines related to the earth's magnetosphere, ionosphere, and atmosphere; geodesy; solar physics; planetology; and celestial astronomy is discussed. Similar efforts at other universities and colleges and the results of some of their efforts are mentioned. Emphasis is placed on the role of NASA's Sustaining University Program in promoting interdisciplinary leadership and cooperation on both space program and society problems. R.N.A.

N66-39948*# National Aeronautics and Space Administration, Washington, D. C.

[THE IMPACT OF THE TECHNOLOGICAL REVOLUTION]

Robert C. Seamans 26 Oct. 1966 18 p Presented to Board of Trade Meeting, New York, 27 Oct. 1966 Available from the Scientific and Technical Information Division CSCL 22A

A variety of space program related topics are discussed including the technological revolution, its impact, and future implications; some of the products of the space age technology and their applications to society; the interdisciplinary nature of the space effort; and the new trend in engineering schools of combining training, research, and practical application. R.N.A.

N66-39977*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THE UTILIZATION OF TECHNOLOGICAL RESOURCES

James E. Burnett. Washington, NASA, 1966. 20 p. refs. For presentation at the Automotive Eng. Congr. and Exposition, Detroit, 9–13 Jan. 1967; sponsored by Automotive Engr.
(NASA-TM-X-52248) CFSTI: HC $1.00/MF $0.50. CSCL 05C.

The skillful use of new technology has long been a factor in industrial growth, and in recent years it has become the controlling variable determining competitive success. An unusual communication experiment between NASA and the petroleum industry clearly demonstrates the fact that aerospace-related new technology has a substantial content of industrial value. A number of examples are given illustrating this fact. The entire body of aerospace-related technology is now fully and selectively available to industry on a regular working basis through special NASA programs. As a consequence, the technological resources for considered use by any interested company are very large and of demonstrated value. Author

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—NATIONAL AERONAUTICS AND SPACE ACT OF 1958

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TECHNICAL MEMORANDUMS: Information receiving limited distribution because of preliminary data, security classification, or other reasons.

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